

## **Historic, Archive Document**

Do not assume content reflects current scientific knowledge, policies, or practices.





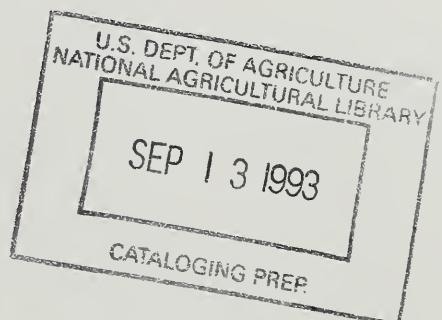
ites  
nt of  
aTD194 ,  
.56  
.N62C37  
1993

Region 3  
Region

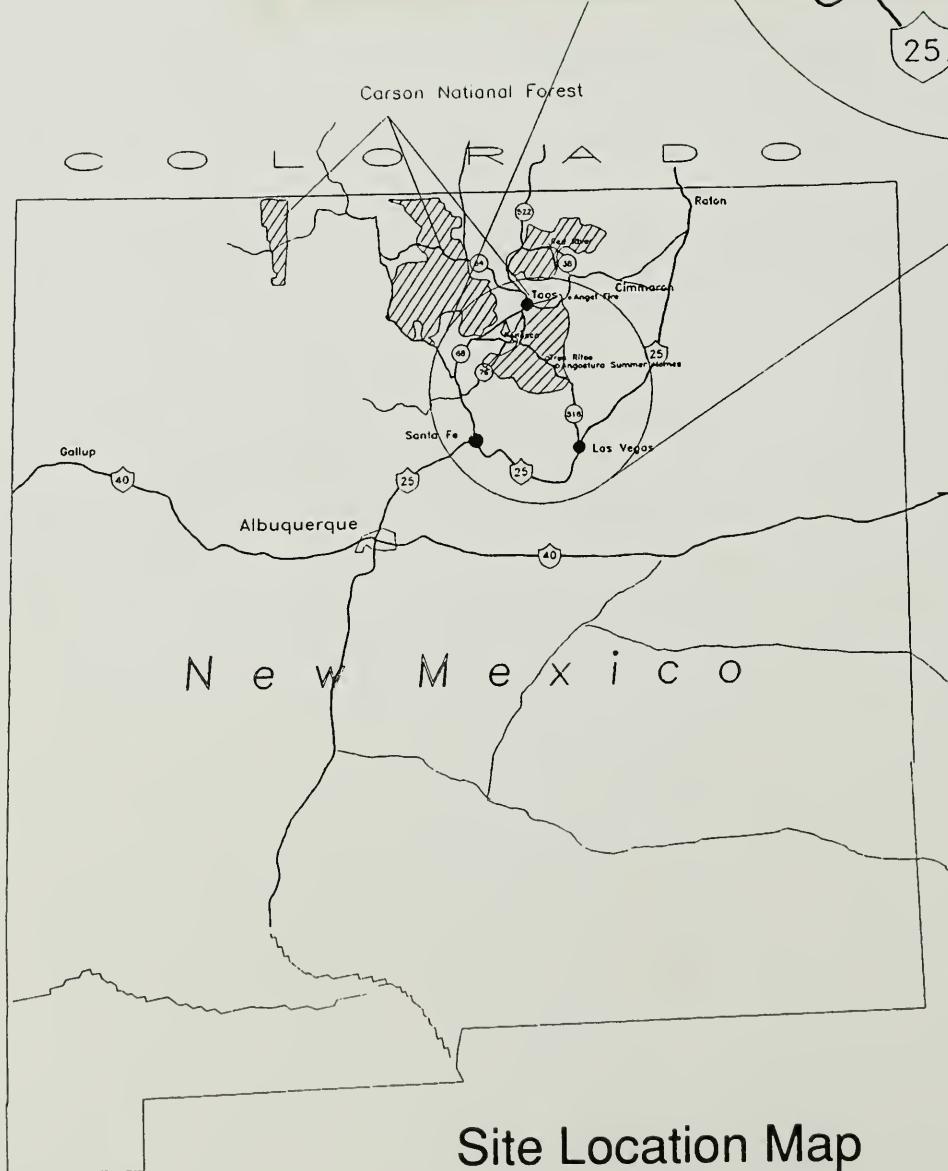


# Angostura Vegetative Management Plan Draft Environmental Impact Statement

Camino Real Ranger District  
Carson National Forest



United States  
Department of  
Agriculture



Site Location Map



Published July 1993 on recycled paper.



United States  
Department of  
Agriculture

Forest  
Service

Camino Real  
Ranger District

P.O. Box 68  
Penasco, NM  
87553

\*\*\* RANGER'S FIELD DAY \*\*\*

The Camino Real Ranger District would like to take this opportunity to invite you on our Ranger Field Days. This day is specially set aside for you so that you can first-hand see the on-the-ground management of your National Forest.

The itineraries of each day trip varies depending on what management activities are going on and also what you, the public, want to see. Past day trips have taken us to see such activities as, planting, thinning, timber sales - both during harvest and post harvest, wilding areas, Aspen management, recreation projects, old growth stands, the NEPA process on different diversity units and projects in the planning stages.

Come join us:

WHAT:	RANGER'S FIELD DAY
WHERE:	CAMINO REAL RANGER DISTRICT OFFICE
WHEN:	FIRST TUESDAY OF EACH MONTH - 9:00 AM
WHY:	TO SHARE AND EXCHANGE INFORMATION WITH OUR PUBLICS ABOUT THE MANAGEMENT OF THEIR NATIONAL FOREST

M. A. Dumas  
District Forest Ranger







United States  
Department of  
Agriculture

Forest  
Service

Carson  
National  
Forest

P.O. Box 558  
Taos, NM 87571  
(505) 758-6200

Dear Friend:

We are pleased to be able to send you a copy of our Draft EIS for the Angostura Vegetative Management Plan of the Carson National Forest. We have tried to incorporate many of the ideas and comments received by many people who expressed an interest. Some of these people have had a lively dialog with us on the ground, in person, or through the mail. Others are waiting to see what our Draft says before commenting.

We encourage your comments, especially if you see that some concern of yours has not been looked into as part of the process. We are especially interested in new information that you think we have overlooked. While opinions are also welcome, it should be obvious that tangible, verifiable information is the most helpful way to support one or another of the alternatives.

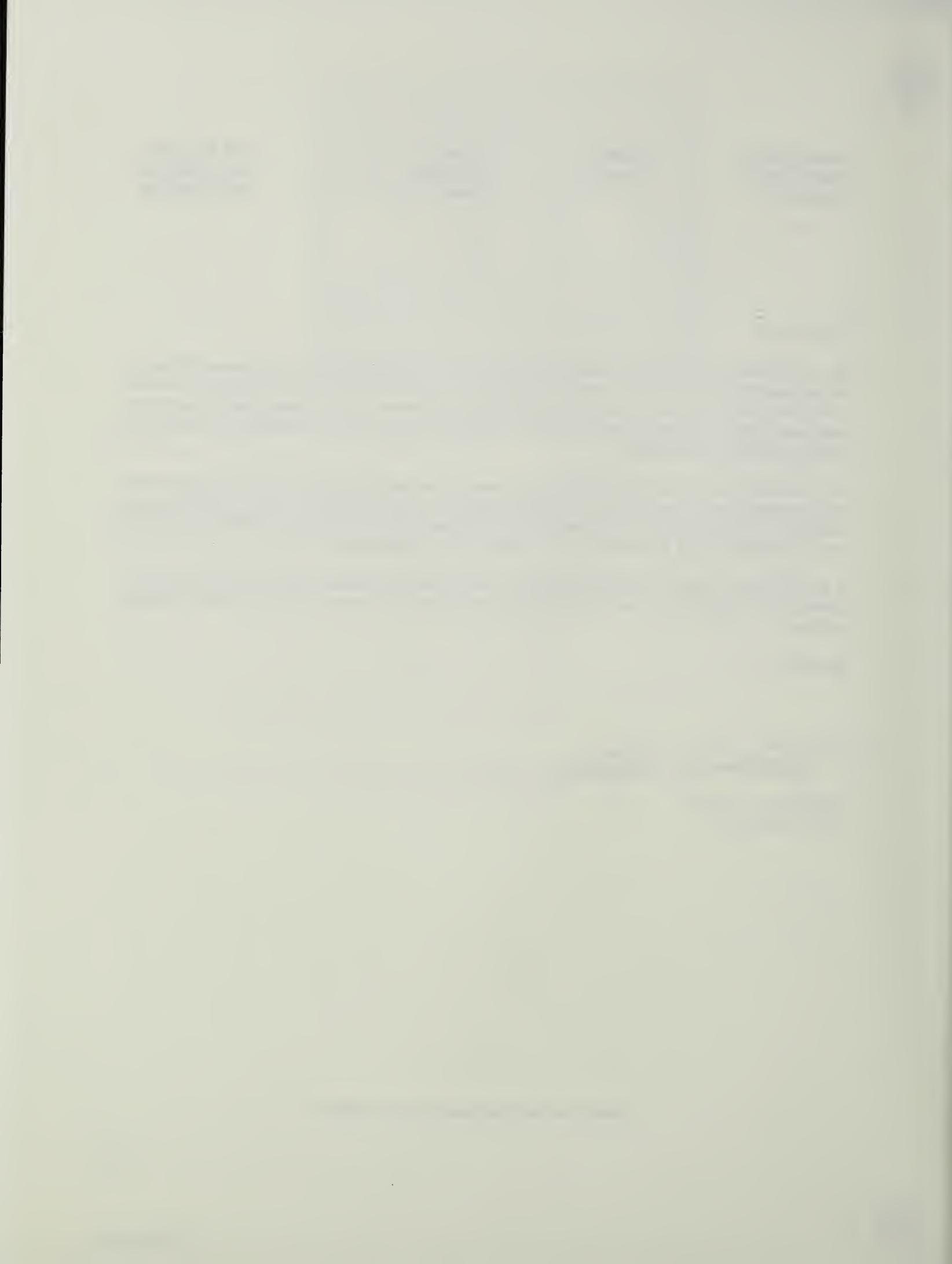
A final decision is going to depend strongly on the comments received. If you have any questions please don't hesitate to call one of the preparers listed in the document. We look forward to hearing from you.

Sincerely,

LEONARD L. LUCERO  
Forest Supervisor

Caring For The Land and Serving People





# **DRAFT ENVIRONMENTAL IMPACT STATEMENT ANGOSTURA VEGETATIVE MANAGEMENT PLAN**

**TAOS COUNTY, NEW MEXICO**

Type of Action:	Administrative
Lead Agency	USDA Forest Service
Responsible Official:	Leonard L. Lucero, Forest Supervisor P.O. Box 558 Taos, New Mexico 87571
For Further Information:	Carol Holland Camino Real Ranger District P.O. Box 68 Penasco, New Mexico 87553 (505) 587-2255

***Abstract:***

The Carson National Forest proposes to harvest and regrow timber in the 10,132 acre Angostura Diversity Unit to implement Carson National Forest Plan objectives. Seven alternatives were developed and the estimated effects of implementing each alternative are evaluated.

The Forest Supervisor will decide on whether or not to use timber harvest in the Angostura Diversity Unit to accomplish Forest Plan objectives. If a timber harvest alternative is selected, the Forest Supervisor will decide on a timber sale design, amount of timber to harvest, areas to allocate for protection of old growth, transportation system design, road closures and obliterations, and post-sale treatments, such as thinning or prescribed burning connected with the timber harvest.

Comments on this draft must be received by the District Ranger; USDA Forest Service; P.O. Box 68; Penasco, New Mexico 87553. Comments are due by close of business on **NOV 08 1993**

In addition, Federal court decisions have established that reviewers of draft environmental impact statements must structure their participation in the environmental review of the proposal so that it is meaningful and alerts an agency to the reviewers' position and contentions. *Vermont Yankee Nuclear Power. v. NRDC*, 435 U.S. 519, 553 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement. *City of Angoon v. Hodel*, (9th Circuit, 1986) and *Wisconsin Heritages, Inc. v. Harris*, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980). The reason for this is to ensure that substantive comments and objectives are made available to the Forest Service at a time when it can meaningfully consider them and respond to them in the final.

1000000

# CONTENTS

TOPIC	PAGE
<b>1. PURPOSE AND NEED FOR ACTION</b>	1
Proposed Action	2
Purpose, Need for Action and Issues	3
Background	17
Decisions to be Made	18
<b>2. ALTERNATIVES</b>	19
Alternative Development	19
Alternatives Considered But Eliminated From Detailed Study	20
Alternatives	22
Mitigation Measures Common To All Harvest Alternatives	33
<b>3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES</b>	37
Vegetation	37
...Age Class and Canopy Cover	38
...Forest Health	45
...Sustainability	46
...Old Growth	51
Soil and Water	60
Wildlife	66
...Threatened, Endangered and Sensitive Species	67
...Wildlife and Wildlife Habitat	68
...Disturbance	75
...Snags and Closed Canopy Forest	76
...Fisheries	77
Roads	85
...Economic Efficiency	85
...Public Safety and Protection	86
Economics	87
...Harvests and Employment	87
...Costs and Benefits	88
Recreation	91
...Visual Quality	91
...Recreation Experience	91
Cultural Resources	92
Air	92
Potential For Wilderness Designation	92
<b>APPENDICES</b>	
Appendix A - Consultation With Others	94
Appendix B - Preparers	99
Appendix C - Process Record	102
Appendix D - Glossary	104

# LIST OF MAPS

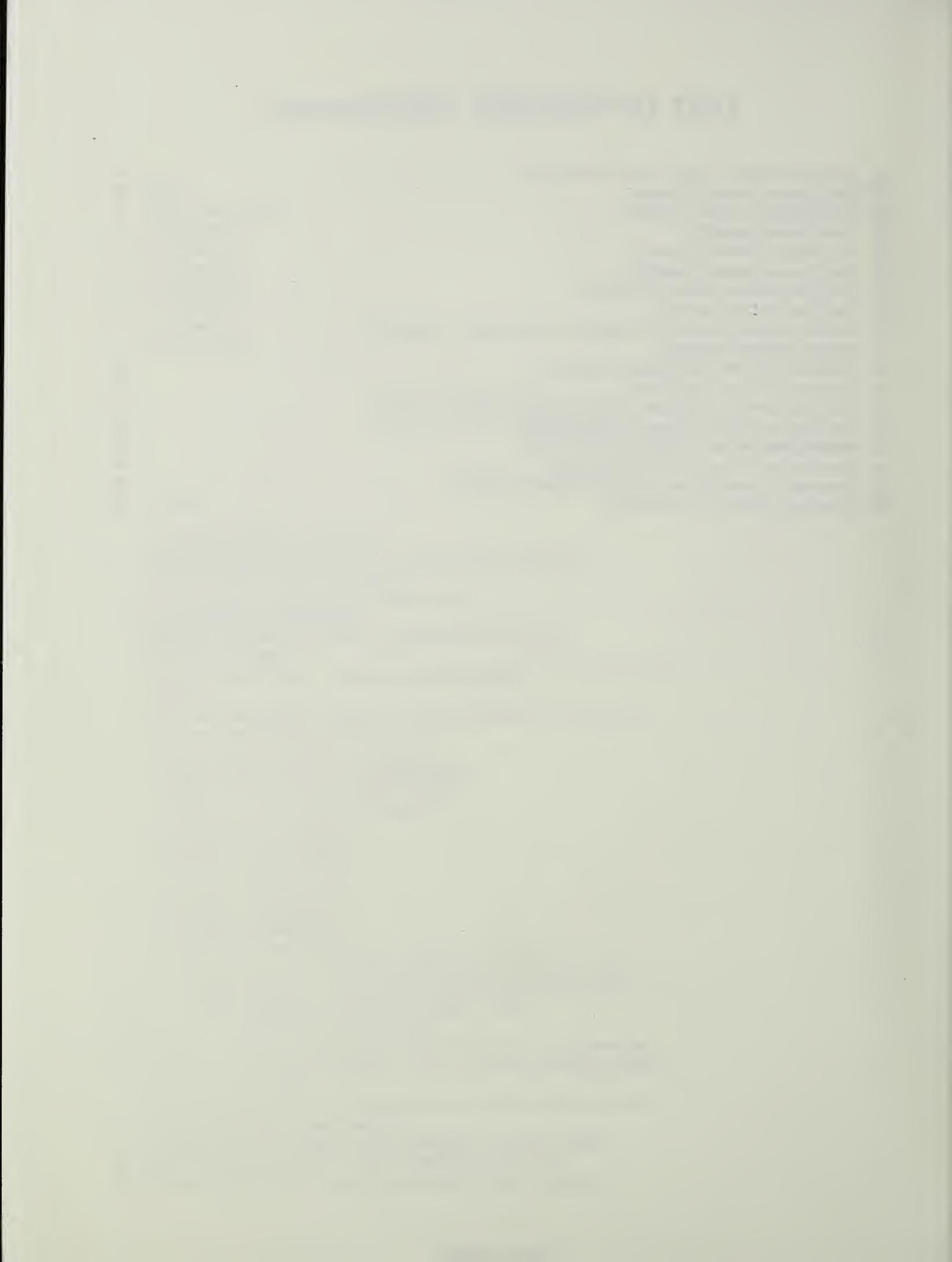
#	MAP	PAGE
1	Site Location Map	Inside Front Cover
2	Alternative A	26
3	Alternative B	27
4	Alternative C	28
5	Alternative D	29
6	Alternative E	30
7	Alternative F	31
8	Alternative G	32

# LIST OF TABLES

#	TABLE	PAGE
1	Desired Condition of Vegetation	2
2	Relationship of Past, Present and Desired Future Condition With a Need for Action and Issues	3
3	Issues, Their Aspects and Interrelationships	3
4	Comparison and Alternatives	24
5	Mitigation Measures Common to Alternatives B,C,D,E,F,G	33-36
6	Vegetation Types	38
7	Age Class Distribution, Suitable Acres Immediately After Treatment, All Species	39
8	Age Class Distribution, Suitable Acres Immediately After Treatment, Spruce-fir and Mixed Conifer	40
9	Canopy Cover Distribution, All Species	42
10	Canopy Cover Distribution, Ponderosa Pine	43
11	Canopy Cover Distribution, Mixed Conifer	44
12	Alternative A Sustainability (no action)	47
13	Alternative B Sustainability	48
14	Alternative C Sustainability	48
15	Alternative D Sustainability	49
16	Alternative E Sustainability	49
17	Alternative F Sustainability	50
18	Alternative G Sustainability	50
19	Existing and Potential Old Growth Acres	52
20	Existing and Potential Old Growth Acres Remaining (All Species)	53
21	Old Growth Allocation, Total Forested Lands and Suitable Lands Only	55
22	Old Growth Allocation, Spruce-fir and Mixed Conifer	56
23	Forest Old Growth Inventory Summary	58
24	Existing and Potential Old Growth Within the Rio Pueblo Watershed	59
25	Harvest and Road Characteristics Used To Estimate Soil/Water Effects For the Analysis Area	61
26	Temporary Unsatisfactory Watershed Conditions Following Harvest Under An Extreme Case Scenario	62
27	Alternative Characteristics Used To Estimate Soil/Water Effects	63
28	Timber Sales in Upper Rio Pueblo Watershed 1986-1996	66
29	Vegetative Structural Stages For Upper Rio Pueblo Watershed	68

## **LIST OF TABLES (continued)**

30	Absolute Diversity Index For Each Alternative	69
31	Elk Summer Habitat Capability	70
32	Deer Summer Habitat Capability	70
33	Bear Habitat Capability	71
34	Pine Marten Habitat Capability	71
35	Red Squirrel Habitat Capability	72
36	Hairy Woodpecker Habitat Capability	72
37	Goshawk Habitat Capability	73
38	Wildlife Habitat Capability in Angostura Analysis Area - Percent of Existing Habitat Capabiility	73
39	1988 and 1991 Rito Angostura GAWS Data	79
40	1988 Aqua Piedra GAWS Data	80
41	1989 Rio Pueblo GAWS Data	81
42	New Stream Channel Crossings By Alternative	83
43	Baseline Magnitude of Habitat Loss in Percent	83
44	Road System Mileage and Projected Cost	85
45	Summary of Local Effects - Angostura Sale Alternatives	88
46	Costs and Benefits By Alternative	89



# 1. PURPOSE AND NEED FOR ACTION

During the development of the Carson National Forest Land Management Plan, all lands administered by the Carson National Forest were classified to determine their "suitability" in regard to applying certain resource management practices considering economic and environmental consequences. Those lands classified as "suitable" forest land are to be managed for timber production on a regulated basis. This does not preclude management for other resource objectives as well. Approximately 1/3 or 380,000 acres of the land base administered by the Carson National Forest is currently classified as suitable forest land. Within the Angostura analysis area (10,132 acres) there are approximately 4,539 acres classified as suitable forest land. The suitability of the analysis area has been determined in the Environmental Impact Statement for the Carson Forest Plan which was developed with full public participation and disclosure. Therefore the suitability of this area for timber management activities, including logging, is not an issue in this EIS. When, where and how timber management and related activities will occur on a site specific basis and the potential impacts and

significance of those impacts from timber management activities is an issue and will be addressed in this EIS. In summary, the decision to harvest timber upon the suitable forest lands within the Angostura analysis area has been made through the Carson Forest Plan EIS. This EIS will address the site specific questions of how, where, and when those timber management activities will occur and the economic and environmental consequences, and the significance of those consequences.

This environmental impact statement (EIS) shows the effects of the proposed timber sale(s) in the Angostura analysis area. An interdisciplinary analysis on the proposed timber sale is documented in a project record containing over 300 documents. An index of the project record is presented in Appendix A. Documents from the project record are incorporated by reference throughout this environmental impact statement by showing the document number in parentheses(#). This environmental impact statement summarizes the analysis in the project record to make the analysis results as clear as possible.



## PROPOSED ACTION

The proposed action evolved throughout the analysis. The proposed action was developed to correspond with the resource standards and guidelines in the Forest Plan in regard to achievement of desired future conditions. Alternatives described in Chapter Two were developed as a result of addressing issues which were identified from scoping efforts. The issues were identified as a result of public involvement (open houses, field trips, meetings etc.) and resource specialist information. The proposed action may change as a result of further analysis and/or public involvement once the draft environmental impact statement is issued and reviewed by the deciding official, the

interdisciplinary team, resource specialist, and the general public. The final proposed action may be one or a combination of the alternatives described in Chapter Two. At this point in time the proposed action consist of:

- Harvest between 700 to 950 acres (7% to 9%) of the Angostura analysis area. This harvest will involve between 575 and 740 acres (18-25%) of the spruce-fir and 125 to 210 acres (5-8%) of the mixed conifer. Harvest will be done through one or several sales.
- Harvest done to create the following conditions:

Table 1. Desired Condition of Vegetation

SUCCESSIONAL STAGE	EXISTING AGE CLASS DIVERSITY	DESIRED SUCCESSIONAL STAGE DIVERSITY (AFTER TREATMENT)	DESIRED SUCCESSIONAL STAGE DIVERSITY (50+ YEARS)
EARLY 0-40 YEARS ...Acres ...% of Suitable	0 0%	308-327 7	1316 29
MID 40-80 YEARS ...Acres ...% of Suitable	1,164 25	1152-1368 25-30	1316 29
MID 80-160 YEARS ...Acres ...% of Suitable	3,291 73%	2844-2976 62-66	1316 29
LATE 160+ YEARS ...Acres ...% of Suitable	84 2%	20-84 1-2	591 13

- Between 125 to 201 acres (18 -28 percent of priority areas) of mistletoe and spruce budworm infested areas will be treated to reduce infestation to normal endemic levels.
- Between 0 and 64 acres of existing old growth will be harvested. Between 2,450 to 2,600 acres or 28 to 30 percent of the forested area within the Angostura analysis area will be allocated to old growth.
- There are 1.5 miles of existing roads. From 11.0 to 12.0 miles of new road will be constructed, all of which will be closed at the end of the sale(s) once the public have been allowed to remove the firewood and vigas. Short term road density (5-7 years) will go from .09 to .69 - .85 miles per square mile then revert back to 0 - .09 after management activities. 0 - 1.5 miles of existing roads will be reconstructed depending upon the alternative selected.
- 44 to 50 acres of aspen will be encouraged to resprout younger trees. This will be done through firewood harvest in existing stands.
- Approximately 2,275 to 3,855 cords will be made available for firewood from timber sale slash (debris).
- 2,800 to 4,400 thousand board feet (2.8 to 4.4 MMBF -- million board feet) will be made available for sawtimber. These volumes are estimates using data from stand examinations. The actual volumes once the timber is accurately measured may exceed or fall short of these estimates.
- 7,000 personal-use and/or commercial vigas will be made available through commercial thinning from below treatments to improve residual tree growth and vigor in the spruce-fir forest type.
- 175 to 375 acres will be thinned to increase tree growth and vigor.

## PURPOSE, NEED FOR ACTION AND ISSUES

This section sets the stage for the entire analysis. It relates the *past*, *present*, and *desired future conditions* with one another. Based on the review of the three conditions, it looks at any *need for action* and any resulting *issues* that could arise.

Table 2. shows how topics will be discussed within the context of *past*, *present*, and *desired future condition*, *need for action*, and *issues*.

Table 2. Relationship of *Past*, *Present* and *Desired Future Conditions* With a Need for Action and Issues.

TOPIC (ISSUE)		
PAST CONDITION	PRESENT CONDITION	DESIRED FUTURE CONDITION
This discussion is based on review of literature, research, historical accounts of people traveling through the area and old photos. There usually is little hard factual information. The time frames for the past conditions varies with the topic.	Often, the past is imprinted in, and reflected by, the present condition.	The desired future conditions are defined by the direction in the Carson Forest Plan.
NEED FOR ACTION		
<input type="checkbox"/> The past condition provides a context for reviewing the present and desired future conditions. The <i>need for action</i> is demonstrated by comparing the present with the desired future condition. None of these conditions is "correct", "good" or "bad". They are just conditions at three different times. The <i>need for action</i> defines the objectives for the project. Also, review of all the <i>Need for Action</i> statements discloses the purpose of the project.		
ISSUE		
Problems or opportunities may be created by taking an action to bring current conditions closer to desired future conditions. These problems or opportunities are called <i>Issues</i> . Not all <i>Needs for Action</i> will develop issues. Issues are only those items that cannot be resolved and that we develop alternatives around.		

It is always difficult to agree on topic headings, because there is often subject overlap. For example, old growth is a part of vegetation diversity, but was made

a separate topic in this analysis because of the extent of the discussion. So you will need to read all the topics to get the full picture.

Table 3. Issues Used To Develop Alternatives and Their Aspects and Interrelationships

Issues (Topic)	This Analysis Deals With These Aspects of That Issue	This Issue Also Relates to Discussion in These Other Issues
Vegetation Diversity	Age Class, Canopy Cover, Wildlife	Old Growth
Old Growth	Allocation	Vegetation Diversity, TES Species, Wildlife Habitat
Water	Quantity and Quality	Roads
Forest Health	Dwarf Mistletoe, Spruce Budworm, Spruce Bark Beetle	Vegetation Diversity, Old Growth
Roads	Wildlife, Sediment, Firewood	Water, TES Species, Economics
TES Species	TES Species Habitat	Vegetation Diversity, Old Growth, Roads
Wildlife Habitat	Habitat Capability	Vegetation Diversity, Roads
Recreation	Impacts	Visual Quality, Roads

Table 3. Issues Used To Develop Alternatives and Their Aspects and Interrelationships (continued)

Issues (Topic)	This Analysis Deals With These Aspects of That Issue	This Issue Also Relates to Discussion in These Other issues
Visual Quality	Vegetation Diversity, Visual Quality Objectives	Roads, Recreation Experience
Economics	Jobs, Income, Costs/Benefits	Roads

## VEGETATION DIVERSITY

### PAST CONDITION

Approximately 56% (5,639 acres) of the diversity unit consists of the Spruce-fir forest type. Within the spruce/fir forest type, insects, primarily the spruce bark beetle, played a major role in creating and maintaining vegetation diversity during pre-settlement times. Spruce beetle outbreaks may be as significant as fire in the development of spruce-fir forests (Baker and Veblen 1990) (LR1992, page 145). Spruce beetle outbreaks have been well documented during the last 100 years. On the White River National Forest, Colorado, in the mid 1870's, 10-25% of the mature spruce were found dead (Sudworth 1900a), while 25%-40% of the mature spruce on the Grand Mesa, Colorado were also dead (Sudworth 1900b). More recently, the Grand Mesa and White River National Forests, Colorado, have had extensive outbreaks. An infestation on the White River National Forest from 1939-1951 killed 99% of the spruce over 10" d.b.h. (Schmid and Frye 1977) and altered species composition from 90% spruce/10%fir to 20% spruce/80% fir (Schmid and Hinds 1974). Spruce bark beetles are normally endemic to southwestern spruce-fir stands, with outbreaks occurring primarily in mature stands which have experienced blowdown problems. In the endemic and low level outbreak stages, much of the mortality from the beetles originates from single or small groups of trees scattered throughout the forest, creating "gaps" or openings in the forest canopy cover.

Whether in endemic or epidemic proportions, spruce beetle was a major contributor along with fire, for the ecological succession within the spruce-fir ecosystem during pre-settlement times. Spruce beetle infestations have immediate and long term effects on the spruce-fir ecosystem. The immediate effect changes the stand structure and species composition. The long term effect comes from successional changes in the stand caused by the death and subsequent regeneration of the spruce (LR1977, page 19). Comparing green stands to beetle-killed stands, grasses and sedges show increased density in dead stands (Yeager and Riordan 1953). Forbes were 2.3 times more numerous in dead stands, while browse plants showed a steady, unexplainable decrease. The greatest density, number of species, and index of occurrence of plants was in beetle killed stands (LR1977, page 22).

Fires also played a key role in the natural succession of spruce-fir forests. Although relatively infrequent

because of the higher moisture regimes at higher elevations, they were usually severe, stand replacement fires covering medium to large areas (1,000 - 10,000 acres), and in many cases followed spruce beetle outbreaks which significantly increased fuel loads. In subalpine forests of Rocky Mountain National Park, Colorado, there was an estimated 1 fire > 4 ha per 8100 km<sup>2</sup> per year, prior to 1870 (Clagg 1975, in Romme and Knight 1981). Stand devastating crown fires were most common, but many fires were probably patchy, skipping across valleys, or burning as surface fires and crowning out wherever fuel and topography were favorable (Romme and Knight 1981, Baker and Veblen (1990)). Light surface fires may have been common in open spruce-fir forests near timberline, where fuel loads were less (Baker and Veblen 1990). Stand-devastating fires probably ranged from a few hectares to conflagrations covering tens of thousands of hectares, similar to the 1988 Yellowstone fires. Some areas undoubtedly remain unburned for centuries or millennia, either by chance or because local physiography inhibits fire (Romme and Knight 1981) (LR1992, page 145). Insects and fire played a major role in the natural life cycle of the spruce/fir ecosystem.

These natural agents created a mosaic of diverse vegetation successional stages and stand structures over the landscape. A popular notion with the public is that a primeval old-growth spruce-fir forest, stable and unchanged for centuries, covered most of Colorado's [and Northern New Mexico's] subalpine zone prior to European settlement. However, historical records and dendroecological evidence indicate that recurrent coarse-scale disturbances (fire, spruce beetle epidemics, and blowdowns) were an integral part of subalpine forest dynamics: "The coniferous forests of the Rocky Mountains can best be described as disturbance phenomena. Owing to the agencies of fire, wind and insect attack, these forests are periodically destroyed in a patchwork manner, resulting in a mosaic of stands of different ages and histories" (Peet 1981) (LR1992,Page 144). Under a natural disturbance regime, subalpine forests were probably characterized by a mosaic of stands in various stages of recovery from disturbance, and old growth was just one part of the larger forest mosaic (Peet 1981, Romme and Knight 1981). This mosaic was constantly changing and highly variable from place to place (LR1992, page 146). From the available research, it can be deducted that pre-settlement spruce fir ecosystems contained a diverse array of

successional stages from early to late successional stages with varying stand structures.

Approximately 17% (1,773 acres) of the diversity unit consists of high elevation mixed conifer forest type. Pre settlement conditions within the high elevation mixed conifer type were probably similar to the spruce-fir type. Since this type occurs at a slightly lower elevational range, fires were probably slightly more frequent as evidenced by the numerous aspen stands within the mixed conifer ecosystems within the analysis area which were created by fires. The spruce budworm played a similar role in the mixed conifer as the spruce beetle in the spruce-fir. Endemic and low level outbreak budworm populations acted as a natural thinning agent, attacking susceptible single trees or groups of trees. Epidemic (outbreak) populations of budworm along with the douglas fir bark beetle caused high mortality rates. Fire, budworm and bark beetles all played important roles in the natural succession of mixed conifer forests. Similar to the spruce-fir type, pre-settlement conditions likely consisted of a diverse array of successional stages from early to late successional stages with varying stand structures.

About the turn of the century to 1930, the Angostura area was logged by the Santa Barbara Tie & Pole company. There are several historic sites within the analysis which document this early logging such as old logging camps, sawmill sites, large piles of wood waste, and remnants of logging flumes. The logs were transported from the area by horse and wagon or by the use of flumes and check dams using water to carry the logs into the Rio Pueblo and eventually into the Rio Grande. The existing road and trail network within the diversity unit were constructed during this early logging operation. There are still several residents living within the surrounding communities which remember the logging operation and some were directly involved. The primary objective of the early logging was to produce lumber and ties. From analyzing the current vegetation conditions, it can be deduced that almost all of the trees which were of merchantable size were harvested.

## PRESENT CONDITION

For the purpose of this analysis, the vegetation conditions are categorized into the following categories:

### Early successional (0 - 40 years old)

It is assumed that the benefits derived from early successional vegetation conditions, such as grass and forb production, last approximately 40 years after harvest or natural disturbances, at which time tree

regeneration has completely been established and the canopy will start closing, restricting grass and forb production. This category corresponds to and combines the grass/forb and shrub/seedling age classes described in the Forest Plan.

### Mid successional (40 - 80 years old)

This category corresponds to the sapling/pole age class described in the Forest Plan. It is estimated that it takes approximately 80 years for the spruce-fir and upper mixed conifer trees to grow to a sawtimber sized diameter (9" Diameter @ 4.5" above ground)

### Mid successional (80 - 160 years old)

This category corresponds with the Mature age class described in the Forest Plan. It includes trees from 9" DBH and larger up until old growth conditions are developed. The term mid successional is used in this category and the previous category to describe the condition between when a stand of trees no longer exhibits characteristics of the early successional stage until the stand starts to exhibit late successional stage conditions such as high snag and down log densities and large diameter trees.

### Late successional (160 years old and older)

It is estimated that within the spruce-fir and upper mixed conifer it takes approximately 160 years for a stand of trees to start to exhibit quality old growth characteristics such as high snag and down log densities. This category corresponds with the old growth age class described in the Forest Plan. In calculating existing old growth and potential old growth, the old growth definition on page Sustainable Forest-5 was used, i.e., A stand did not have to be 160 years old if it met the other characteristics of size and density.

These categories were developed in order to simplify the classes listed on page Wildlife & Fish - 5 of the Forest Plan to make them easier to understand to the average citizen. They were also developed to emphasize the importance of the various successional stages within the forest ecosystem.

In addition the vegetation conditions are categorized and evaluated in relation to canopy cover densities:

<40% canopy cover

40 - 70% canopy cover

>70% canopy cover

Canopy cover density reflects the overall density of the forest which reflects the different types of wildlife species which will inhabit the area. These are the same density classes described in the Forest Plan page Wildlife & Fish - 5.

The present vegetation conditions are a direct result of the early logging mentioned above. The majority of the trees within the analysis area are approximately 80 - 130 years old. The current 120-130 year old trees were approximately 40-50 years old when the area was first logged. These trees were not considered merchantable at that time because they were too small and consequently these were the trees which were left standing. The extensive Aspen stands and young spruce/fir stands in the western half of the diversity unit were likely created by fires during and after the logging operation. These fires were likely intense, stand replacement fires fueled by the slash from the logging activities.

At present, there is little diversity of age classes and canopy cover. Approximately 70% of the forested acres within the diversity unit consist of dense stands of trees 100 to 130 years old which average approximately 12-14 inches in diameter. Approximately 25% of the acres consist of younger, dense stands (40 to 80 years old) which were most likely created by fires following the early logging operations. Approximately 8% of the forested acres meet Forest Plan criteria as old growth or late successional conditions. Essentially none (less than 1%) of the forested acres within the diversity unit exhibit early successional stage conditions. Currently 91% of the forested acres within the diversity unit consist of stands which have a canopy cover greater than 70%. This relatively dense condition is typical of spruce-fir, upper mixed conifer forests of this age. Approximately 8% of the forested acres have a canopy cover closure of 40-70% and 1% of the forested acres have canopy cover closure of less than 40%.

## DESIRED FUTURE CONDITION

"VISION: • We focus on the forest -- a total ecological system -- a recycling system. It is a system involving birth, growth, maturity, death, and a rebirth. We acknowledge the need to manage for the whole cycle, the part we see and the unseen. The focus is on a sustained forest, versus sustained yield--the total forest cycle versus a product from one phase of the cycle.

- Maintain options for the future -- invest in the future versus squandering our inheritance while allowing sound uses for today.
- Maintain genetic and ecological diversity and soil productivity.
- Consider an area's position within the landscape in making all decisions. Develop diverse forest types

and stand conditions, similar to that which occurred under prehistoric conditions" (LR1986.1, page Sustainable Forest-2).

"By 2030 the age class distribution on suitable land will be improved as the result of regularly scheduled regeneration harvests. General stand health and vigor will be improved, and dwarf mistletoe and western spruce budworm problems reduced as the result of timber harvest and precommercial thinning. Wildlife habitat diversity will be greater than present through application of integrated stand management; cover requirements will be fully met" (LR1986.1, page Carson Overview-4-5).

"To work towards a balanced age class distribution on a Forest-wide basis, complete regeneration harvests on 3 to 15 percent of each forest cover-type (Management Area 1, 2, 3, & 4). As permitted by the existing distribution of stand conditions, apply this guideline on a diversity-unit basis" (LR1986.1, page Timber-9).

"Harvest of forest products will be designed to resemble natural patterns of the landscape" (LR1986.1, page Sustainable Forest 2).

Desired age class distribution on 70 percent of the suitable timberland is about 20-26 percent in grass/forbs and shrub seedling (0 to 40 years), 30-39 percent in saplings/poles (40 to 80 years), 30-39 percent in mature timber (80 to 160 years), and 6 percent in old growth (160 years +) (LR1986.1, page C.Wildlife & Fish 4 & 5).

## NEED FOR ACTION

Action is needed to move the existing age class and canopy cover distribution toward the desired future condition. If current conditions continue, the forest will continue to become more homogeneous with resulting reductions in wildlife and vegetation diversity and higher risk of catastrophic fires and/or insect outbreaks.

## ISSUE

The proposed level, timing, and location of timber harvest may affect the vegetative diversity which may adversely or positively affect wildlife habitat for different wildlife species. Changes in age class and canopy diversity may cause fragmentation of habitats and reduce habitat effectiveness.

## OLD GROWTH

### PAST CONDITION

A generic definition of old-growth forest in current use by the U.S. Forest Service states that old growth forests are "later stage(s) in forest development which may be distinctive in composition but are always distinctive in structure from earlier (young and mature) successional stages". The words, "development" and "successional" are essential. Succession informs us that the composition of the plant community in earlier stages differs predictably from the plant community of later stages. Development implies that the structure of old growth differs predictably from the structure of later stages (LR1992, page 18).

Old growth forests are unique ecosystems that are an important component of biological diversity. Old growth occurs at some point in the later stages of the development of a stand. The later stages of development differ from earlier stages by structure such as tree size, standing and down dead trees, number of canopy levels, age and the composition of the understory species. Old growth is typically distinguished from younger growth by several of the following stand attributes:

- large trees for species and site.
  - variation in tree sizes and spacing.
  - standing and down dead trees.
  - decadence in the form of broken or deformed tops or bole and root decay.
  - multiple canopy layers.
  - gaps in the tree canopy and understory patchiness
- (LR1992, page 106)

Because of the lack of records (photos, journals etc) it is difficult to estimate how much old growth existed in the area previous to human activity. Humans have affected the vegetation conditions for thousands of years since American Indians started using fire to clear areas and improve hunting success. South of the diversity unit, within the Pecos wilderness there are good examples of spruce-fir old growth stands 200 years plus which have not been logged and seem to have developed naturally, with the exception of fire exclusion. These stands provide a basis for describing the important characteristics of old growth spruce-fir and the conditions which created the old growth attributes. In the spruce-fir habitat types, sub-alpine fir is the most tolerant species and theoretically would be the climax species excluding fire and insects or other natural disturbances. In reality because sub-alpine fir is a shorter lived species than engelmann spruce, the late successional condition of

spruce-fir consists primarily of an overstory of large engelmann spruce of varying densities. As the spruce bark beetle is important to creating a diversity of successional stages over the landscape during epidemic or outbreak populations, it also seems to play a key role in the development of spruce-fir old growth during endemic or low level epidemic populations. As spruce-fir stands grow older, they become more susceptible to beetle attack, primarily because tree vigor and growth decreases. As the trees within a stand matures, the beetles attack and kill individuals and groups of mature trees. The death of these trees starts the cycle of creating stand characteristics which are important components of old growth forests such as dead standing trees and dead fallen trees. As individual and/or groups of trees are attacked and killed, gaps or openings are created in the canopy and allows sunlight to hit the forest floor. Grass and forbs are quickly established in these small openings and conditions for regeneration of spruce-fir are favorable. Spruce-fir regenerates and starts the growth cycle over again. Old-growth forest structure is a function of both age and stand history. Gaps and spacial patchiness result from internal stand events which occur both continuously and in episodes (Debell and Franklin 1987). Mortality of dominant trees creates a patchy gap pattern in some forest types (e.g., Veblen 1986a). As development proceeds, the gaps fill with regenerating trees (LR1992, page 21). This cycle of death and subsequent regeneration within the stand will persist until a catastrophic event such as fire or severe insect epidemic disrupts it and ends the old-growth stage of forest development, moving the stand into an early successional stage.

From observations of stands within the Pecos Wilderness, there seems to be a relationship between the age of a stand and the percentage of openings within the stand. Generally, the older the stand, the larger proportion of openings there are within the stand because of increased mortality rates. Many of the old stands within the Pecos Wilderness contain as much as 40% in early successional habitat (grass/forbs, seedling/sapling) created from naturally occurring gaps/openings in the mature canopy. These stands, because of their high degree of vegetation diversity, provide habitat for many species of wildlife and micro and macro vertebrates and invertebrates. It could be concluded that excluding fire, beetle epidemics, other natural disasters, and human intervention, there would be vast acreages of late successional conditions within the spruce-fir which contained up to 40%

in openings within the stands and these stands could be continually sustained in this condition. However, historical records and dendroecological evidence from Colorado indicate that recurrent coarse-scale disturbances (fire, spruce beetle, epidemics, and blowdowns) were an integral part of subalpine forest dynamics (LR1992, page 144). In summary, spruce-fir forests during pre-settlement times most likely contained a significant component of late successional conditions. These late successional forest conditions provided both early and late successional vegetation conditions in varying amounts. Under a natural disturbance regime, subalpine forests were probably characterized by a mosaic of stands in various stages of recovery from disturbance, and old growth was just one part of the larger forest mosaic (Peet 1981, Romme and Knight 1981). This mosaic was constantly changing and highly variable from place to place. (LR1992, page 146).

Development of old-growth forests within the upper mixed conifer habitat types are similar to the development of spruce-fir old growth forests.

### **PRESENT CONDITION**

There are presently 706 acres of existing old-growth within the Angostura analysis area. 600 acres are within the spruce-fir forest type and 106 acres are within the mixed conifer type. With the exception of 84 acres within the mixed conifer type, these old-growth stands are relatively "young" old-growth stands in the early stages of old-growth development. Currently they are not providing a full range of old growth values primarily because snag, down log, and patchiness attributes are below optimum levels. As they mature, these attributes will increase. All but 84 acres are located on lands classified as not suitable for timber management. All of the spruce-fir old-growth acres are located on lands classified as not suitable for timber management. 84 acres of the mixed conifer old-growth is located on lands classified as suitable for timber management. No areas have previously been allocated to old-growth.

### **DESIRED FUTURE CONDITION**

"• A key to the sustainable forest is old growth. We will manage old growth to provide the following val-

ues: blueprint and sustainability; habitat diversity, recreation and aesthetics; opportunities for spiritual nourishment; high quality products.

• Over time, we will have old growth well distributed throughout the Forest.(LR1986.1, page Sustainable Forest-2)

"• Approximately 18 percent of each of the major forest types (ponderosa pine, mixed conifer, spruce, fir, and pinon-juniper) will be allocated to old-growth/potential old-growth condition. It is recognized that in areas of lower site quality and/or more frequent natural disturbance, a significant portion of allocated stands may never develop into complete old-growth/potential old-growth conditions. (The 18 percent old-growth figure was derived from wildlife habitat models. It was inferred from the models that a variety of stand age and canopy densities best provided for all the wildlife species of the forest and was consistent with other uses of the forest. This allocation figure may change as the old-growth inventory is completed or the definition is refined.)

• Allocate at least 6 percent of land scheduled for harvest and 18 percent total forested acres within each wildlife and vegetation diversity unit to old growth/potential old growth. (The 6 percent old-growth allocations will not be relegated solely to wilderness, sites not planned for harvest and semi-primitive areas. This allocation figure may change as the old-growth inventory is completed or the definition is refined.)" (LR1986.1, page Sustainable Forest-7)

### **NEED FOR ACTION**

Action is needed to identify and allocate sufficient areas for old growth to help achieve the values described in the desired future condition.

### **ISSUE**

If sufficient old growth areas are not identified and allocated, the proposed timber harvest may cause a loss of existing and potential old growth. Old growth habitats may be fragmented and reduce their habitat effectiveness.

## **WATER**

### **PAST CONDITION**

The communities have used water from the forests for over a century to irrigate their crops.

### **PRESENT CONDITION**

The Angostura analysis area lies within the Rio Pueblo watershed which is a major tributary to Embudo Creek, a tributary of the Rio Grande in Northern New Mexico. The Rio Pueblo watershed drains approximately 84,250 acres. The analysis area is drained primarily by Rito Angostura and Agua Piedra Creek with some smaller drainages, i.e., Knob Creek. Approximately 4,900 acres of the analysis area is drained by the 6,400 acre Angostura watershed, 3,550 acres of the analysis area is drained by the 4,150 acre Agua Piedra watershed, and the remaining 1,650 acres are drained by "face" drainages such as Knob Creek. Both Rito Angostura and Agua Piedra Creek are perennial streams which support resident populations of fish.

### **DESIRED FUTURE CONDITION**

**"A VISION OF THE FUTURE:** Clean, clear, and sustained water flows through the streams and into the rivers.

**"MANAGEMENT HIGHLIGHTS:** • Best management practices are followed when doing all projects and activities.

• An estimated 345,000 acre-feet of water will come off the Forest and will meet water quality standards" (LR1986.1, page C. Watershed-1).

### **NEED FOR ACTION**

The need for action is to mitigate any proposed activity to assure it will create no future problems.

### **ISSUE**

Some feel that timber harvesting and associated road construction will significantly increase sedimentation into perennial streams to unacceptable levels. Some feel that timber harvest will affect the timing and amounts of spring runoff. Others refer to studies which show that variations in water timing is related to varying climatic conditions.

## **FOREST HEALTH**

### **PAST CONDITION**

Mistletoe, spruce budworm, and spruce beetle are a natural part of the environment. Records show that they have been present for centuries. It is only when they become epidemic that they create problems. The problems can range from weakening a tree to death. As illustrated in the previous sections on Vegetation Diversity and Old Growth, insects and disease played a major role in developing and maintaining diversity in the forest ecosystem during presettlement times, and continue to do the same today to a certain extent.

### **PRESENT CONDITION**

Presently, there are about 1,454 acres of timber stands that are infected with dwarf mistletoe or infested with spruce budworm.

Insect and disease aerial detection survey flights in 1990 identified spruce budworm infections on 310,000 acres in Arizona and New Mexico. The Carson National Forest had more acres defoliated by spruce budworm (310,000 acres) than any national forest in Arizona and New Mexico. The flights identified moderate to high levels of spruce budworm infestations within the Angostura analysis area. Another aerial detection flight in 1992 indicate budworm populations have since collapsed to undetectable levels. Stand exams and intensive reconnaissance have identified high, moderate, and low levels of spruce budworm and dwarf mistletoe infections. Spruce budworm are defoliating the white fir, Engelmann spruce, blue spruce, Douglas-fir, and Corkbark fir trees. Dwarf mistletoe is infecting the Douglas fir trees.

The dense, even aged spruce-fir comprising the southeast 1/4 of the diversity unit is presently at a moderate risk for spruce beetle attack of epidemic

proportions within the next 40 years because its dense, even-aged conditions provide a continuous food supply which could sustain an epidemic attack. Spruce-fir stands can be rated as to their relative risk for incurring an epidemic attack of spruce bark beetles. Spruce-fir stands are highly hazardous for spruce beetle infestations when the basal area > 150 square feet per acre, average diameter > 16 inches for live spruce above 10 inches d.b.h., proportion of spruce in the canopy > 65%, and their physiographic location is a well drained site in creek bottoms (Schmid and Frye 1976)(LR1992, page 54). The majority of the spruce-fir stands within the Angostura analysis have an average basal area of 130 square feet per acre, average diameter 12-13 inches for live spruce above 10 inches d.b.h., proportion of spruce in the canopy of approximately 60%, and are located on well drained sites. At current growth and development rates, and the exclusion of fire or harvesting, these stands could become highly hazardous for an epidemic within the next 40 years. It has been demonstrated that partial cutting can greatly reduce tree losses and epidemic risk. The success of partial cutting against the mountain pine beetle in 80-125 year old pine stands suggests it could be used to perpetuate old growth pine stands and it is assumed similar practices would be effective against the spruce beetle in spruce-fir stands and the douglas fir beetle in douglas fir stands because douglas fir beetles outbreaks have not been evident following any kind of commercial cutting (LR1992, page 55).

At present, the risk for a severe spruce budworm epidemic is relatively low, primarily because the area has recently experienced a moderate to severe epidemic within the last 5 years. Research has shown that the average return intervals for epidemics is 30 to 40 years (Swetnam and Lynch 1989) (LR1992, page 66). Theoretically, excluding harvesting or fire, the risk for a spruce budworm epidemic could coin-

cide with the highly hazardous spruce beetle condition 40 years from now.

## DESIRED FUTURE CONDITION

**TIMBER HARVEST...**Most control action on suitable lands will be through timber harvest and other treatments to improve or maintain stand vigor and composition resistant to insect and disease conditions. Prioritize treatment of stands with existing or potential for insect or disease problems. Apply priority to sales within the 10 year sale schedule, and to stands within a given sale planning area.

**MANAGE TO PLAY ROLE IN SUCCESSION...**When consistent with Management Area objectives and objectives for adjacent areas that might be affected, insect and disease conditions may be managed to play their role in forest succession through their interaction with host organisms and natural predators. [Not appropriate and other unsuitable] (LR1986.1, page Timber-10).

## NEED FOR ACTION

Action is needed to reduce the susceptibility and risk of high level insect and disease epidemics.

## ISSUE

Some feel this is an excuse to harvest timber and that the potential impacts due to insects and disease are not great or "are just a part of nature". Others feel that as long as the conditions are at endemic levels (natural for the site) it is OK and would prefer to leave things alone. Once conditions become epidemic (exceed natural levels) then control should be considered. Some suggest to minimize impacts by creating conditions that discourage future epidemic conditions

## ROADS

### PAST CONDITION

There were no roads or trails previous to the Santa Barbara Tie & Pole logging operation at the turn of the century. The logging operation created a system of roads which are currently eroding and used primarily as hiking and biking trails.

### PRESENT CONDITION

Roads which were created by the Santa Barbara Tie and Pole Company are primarily used as hiking and biking trails. There is 1.5 miles of existing road which is used for access by adjacent private landholders (Angostura Homeowners). Existing road density is approximately .09 miles per square mile.

Relatively severe erosion is occurring on the old logging roads now used as trails. There is one designated motorcycle trail through the analysis area which receives a moderate amount of use.

### DESIRED FUTURE CONDITION

In Management Area 1 -- Spruce Under 40% slopes, "Construct roads for timber sales with the following guideline: 3.1 miles per square mile for construction first entry; 0.9 miles per square mile for reconstruction first entry; 4.0 miles per square mile for reconstruction second entry" (LR1986.1, page Spruce <40% - 2)

In Management Area 3 -- Mixed Conifer Under 40% slopes, "Construct roads for timber sales with the following guideline: 2.3 miles per square mile for construction first entry; 1.7 miles per square mile for reconstruction first entry; 4.0 miles per square mile for reconstruction second entry. (LR1986.1, page MC <40%-2).

"Install structures, such as gates or barriers, necessary to manage roads to limit or restrict vehicular access into important wildlife habitats" (LR1986.1, page Wildlife & Fish-14).

"● Road management will provide for an environment relatively free from human disturbances to wildlife. Manage over time to achieve the following guidelines for maintaining or improving effective big game habitat:- Summer big game range: 60 percent habitat effectiveness (approximately 1.0 mile/square mile of roads open to public use).- Winter big game range: 75 percent habitat effectiveness (approximately .5 mile/square mile of roads open to public use during the period December 15 - April 15).- Primary winter big game forage and associated cover areas: 90 percent habitat effectiveness (approximately .1 mile/square mile of roads open to public use during the period December 15 - April 15).

"● Whenever possible, design roads so they can be easily and effectively closed (either permanently or temporarily) at a low cost.

"● Permanent roads will be designed to avoid saddles, meadows, ridge tops, and riparian areas whenever economically and physically possible.

"● Install gates or other effective closure methods at onset of road building activity when the objective is to prevent human use patterns from becoming estab-

lished. Closures will be implemented during any period of inactivity exceeding 24 hours. During big game hunting seasons closures will be implemented full-time if necessary to provide additional wildlife security areas.

"● All local terminal roads will be completely closed to public use by no later than two years following completion of a timber sale contract. All other temporary roads will be closed and/or obliterated upon completion of the activity" (LR1986.1, page Wildlife & Fish-10).

"● Roads and trails not needed will be closed and the land managed for natural resource purposes. They may be seeded with grass or, in low-use areas, simply abandoned and left to return to a natural condition on their own. An average of 70 miles will be obliterated each year.

"● Needed roads and trails may be relocated to more desirable locations" (LR1986.1, page Travel-1).

### NEED FOR ACTION

Action is needed to construct/reconstruct a temporary road system to remove forest products resulting from vegetation management activities while adequately protecting wildlife and watershed values.

Provide access for firewood gathering and completion of post sale improvement projects.

### ISSUE

The proposed road construction and subsequent use may disturb wildlife and diminish habitat effectiveness.

The proposed road construction and subsequent use may impair the quality of cutthroat trout fisheries.

Adjacent private homeowners feel improving FR 89 will increase vandalism, increase safety hazard, and invade privacy.

The unroaded character of the area is unique as compared to other parts of the District.

Timber sale slash has historically been collected as firewood. Roads developed for timber harvest are the primary access.

## THREATENED, ENDANGERED & SENSITIVE SPECIES

### PAST CONDITION and PRESENT CONDITION

A list of Federally listed threatened or endangered species that might be found in the analysis area was requested from the U.S. Fish and Wildlife Service, and the reply showed that there are no species currently listed as threatened or endangered which might be found within the Angostura diversity unit and that--prior to consideration for listing--further information was needed on seven additional species: Mexican spotted owl, New Mexican jumping mouse, Southwestern willow flycatcher, Occult little brown bat, Spotted bat, Northern goshawk, and White-faced ibis. In addition, Cutthroat trout is a considered a Forest sensitive species and does inhabit the Rito Angostura and Agua Piedra Creek.

A Mexican spotted owl survey following Region 3 protocol was conducted in 1989 and 1990. No owls, nests or responses were identified.

No occurrences of New Mexican jumping mouse have been identified within the analysis area. Habitat consist of narrow zones of thick vegetation along streams and wet meadows associated with cattail marshes and ponds. Common best management practices such as protection of designated water courses and buffers along water courses protect this habitat.

There have been no known occurrences of the Southwestern willow flycatcher identified within the analysis area.

There have been no known occurrences of the Occult little brown bat identified within the analysis area.

There have been no known occurrences of the Spotted bat identified within the analysis area.

Northern goshawk surveys were conducted in 1991 and 1992 using Region 3 protocol. Two sightings were reported but extensive nest searches failed to locate nesting sites.

There have been no known occurrences of White-faced ibis identified within the diversity unit.

A Boreal owl survey was conducted in the spring of 1989. No owls, nests, or responses were identified. Overall, the area did not appear to characterize the area where other owls have been found.

A survey for pine marten was conducted in 1989. No individuals were located and no signs found or observations made subsequently. Ther has been one reliable sighting within the diversity unit within the last 10 years. The spruce-fir portion of the analysis area appears to be suitable for pine marten.

The Rocky Mountain Wood Lily is generally associated with moist sites within the spruce-fir and mixed conifer vegetative types. No individuals or groups of plants have been located in the area.

In the summer of 1990 cutthroat trout surveys were conducted in Angostura Creek in cooperation with New Mexico Department of Game and Fish. Results indicate a healthy, relatively pure population of native cutthroat trout in the upper reaches of the Rio Angostura.

### DESIRED FUTURE CONDITION

"● Maintain habitat for viable populations of all wildlife and fish species found on the Forest and improve habitat for selected species. This will be accomplished indirectly through intensive coordination of habitat manipulation with other resource activities, and directly through intensive habitat management.  
● Maintain and/or improve habitat for presently listed threatened and endangered species of animals and other species as they are classified as threatened or endangered. Work toward the eventual recovery and delisting of species by the year 2000." (LR1986.1, page Wildlife & Fish-1)

"**IMPROVE HABITAT...** Improve T&E and sensitive species habitat. Improvement projects give priority to recovery of threatened and endangered species and conform to approved recovery plans.

"**DELISTING...**Manage threatened, endangered, and sensitive animal, fish and plant habitats to achieve delisting in a manner consistent with the goals established with the U.S. Fish and Wildlife Service and the New Mexico Department of Game and Fish in compliance with approved recovery plans.

"**SENSITIVE SPECIES...** Manage sensitive species not already on federal lists, to sustain viability and prevent the need for listing as threatened or endangered. Recovery activities will be pursued where pertinent. If a species is proposed for listing, monitor actions to determine effect of management practices

on habitat and the need for conference with U.S. Fish and Wildlife Service. Identify areas where sensitive species occur and manage to maintain or enhance habitat in occupied territory.

"PINE MARTEN...Identify areas where pine marten occur and manage to maintain or enhance habitat in occupied territory. Complete Forest-wide surveys.

"RIO GRANDE CUTTHROAT... Continue activities to improve Rio Grande Cutthroat habitat with the objective of securing the species. Develop Rio Grande Cutthroat trout fisheries within selected areas identi-

fied in conjunction with the New Mexico Department of Game and Fish." (LR1986.1, page Wildlife & Fish-2,3,4)

#### NEED FOR ACTION

Protect potential habitat of threatened, endangered, and sensitive species.

#### ISSUE

Effective habitat for threatened, endangered or sensitive species may be decreased by the proposed sale activities.

### WILDLIFE HABITAT

#### PAST AND PRESENT CONDITIONS

The following is a list of the most commonly occurring wildlife species (other than those mentioned above) within the Angostura analysis area: Deer, Black bear, Elk, Turkey, Red squirrel, Hairy woodpecker.

Because of the dense canopy cover and lack of early successional vegetation, the habitat within the analysis area favors those species which prefer closed canopy, dense forests, which do not depend on species which require early successional conditions as part of their diet. Two good examples are red squirrel and hairy woodpecker. As would be expected, both of these species populations are very high at present within the analysis area. Populations of those species who depend directly or indirectly upon early successional vegetation conditions for a portion of their habitat needs are relatively low in comparison. Species richness (number of species) is low at present because vegetation diversity is low. The more diverse the vegetation conditions, the higher the species richness given that distribution of the vegetation conditions are favorable. Spruce-fir and upper mixed conifer forests normally have low species richness during the period between early and late successional conditions.

The analysis area provides primarily summer habitat for big game animals such as deer, elk, and bear. Most of these animals migrate out of the area during winter to more favorable winter habitat. A survey was conducted in the winter of 1990-1991 by the District biologist and a New Mexico State Game & Fish officer to evaluate the suitability of the area for winter habitat. It was concluded that the area receives very little use by big game animals during the winter (W5/10/91).

#### DESIRED FUTURE CONDITIONS

Maintain habitat for viable populations of all wildlife and fish species found on the Forest and improve habitat for selected species. This will be accomplished indirectly through intensive coordination of habitat manipulation with other resource activities, and directly through intensive habitat management." (LR1986.1, page Wildlife & Fish -1).

"INTEGRATION...Establish and maintain stand diversity through integrated stand management to maintain and improve wildlife habitat diversity and specific habitat components in lands suitable for timber and firewood production. Selected cutting units will average 10-100 acres except as needed to accomplish specific wildlife habitat improvement objectives.

BIG GAME SUMMER RANGES... On big game summer ranges manage suitable timberlands to achieve a diversity of vegetative conditions by balancing timber age and canopy cover classes.

DISPLACEMENT... Minimizing the displacement of big game and other sensitive wildlife, and providing sufficient security areas will be emphasized in the planning and implementation of the Forestwide timber sale program.

ACTIVITIES NOT ADJACENT... The objective will be to arrange timber sales over time and space so that concurrent activities do not occur adjacent to one another. Manage adjacent areas at least as large as the affected area of activity for wildlife security habitat." (LR1986.1, page Wildlife & Fish-4-9).

## NEED FOR ACTION

There is a need to increase species richness by improving the habitat for those species which depend directly or indirectly upon early successional vegetation conditions to meet a portion of their habitat needs.

## ISSUE

Some people feel there is too much emphasis put on managing habitat for big game species while others feel there is not enough emphasis.

Improving the habitat for one indicator species may adversely affect the habitat of another with different requirements.

## RECREATION EXPERIENCE

### PAST AND PRESENT CONDITIONS

The Angostura analysis area receives a moderate amount of recreational use. The largest portion of the analysis area is classified as semi-primitive motorized (SPM). Approximately 2,900 acres are within Mgt. Area 20 semi-primitive non motorized (SPN). Recreational uses within the analysis area are hiking, mountain biking, cross country skiing, hunting, fishing, and all terrain vehicle (ATV) use. Currently there is one designated ATV trail which goes from Agua Piedra Campground south below the knob to Angostura Campground. There are at present two campgrounds within the analysis; Agua Piedra and Angostura Campgrounds. There is currently a decision pending on closing Angostura Campground. Just outside the diversity unit at the southeast corner there is a trailhead which accesses the Pecos Wilderness. This trailhead is located at the end of FR 161.

be apparent. On-site controls and restrictions of use may be present but are subtle. Facilities should be designed for four wheel drive and/or high clearance rugged vehicles.

### SEMI-PRIMITIVE NON MOTORIZED (SPN)...

**Setting:** The environment should be natural appearing with little or no evidence of human intervention. No resource manipulation projects will occur in Management Area 20. In other areas, resource modification and utilization practices should emphasize recreation and wildlife concerns. Recreation user interaction should be low but there may be evidence of other users. Facilities should be designed for non-motorized uses, including foot travel, horseback travel and bicycles. On site controls and restrictions of use should be "subtle" (LR1986.1, page Recreation-3).

### DESIRED FUTURE CONDITION

- Provide a balanced level of developed and dispersed recreation experiences...
- Help the public enjoy their Forest visit and instill an understanding of the resources and uses of their National Forests" (LR1986.1, page Recreation-1).

### NEED FOR ACTION

The need for action is to mitigate any proposed activity to assure that opportunities for a quality recreation experience is maintained or enhanced.

Need to identify areas where recreation opportunities can be enhanced through the proposed timber sale.

## ISSUE

Some feel that timber sale activities interfere with and reduce recreation opportunities.

## VISUAL QUALITY

### PRESENT CONDITION

Visual quality attributes have changed over the years as natural and human activities have changed the landscape. The biggest factor is that the human pop-

ulation has grown significantly during the past century and consequently the significance of visual quality has increased. The biggest impact to visual quality of the area in the past was due to the logging shortly after the turn of the century and subsequent fires. In

instances where aspen stands resulted from natural or human caused disturbances, visual quality has been improved over the long term.

Presently, the analysis area is very visually pleasing. A large portion of the entire diversity unit is visible from the top of the Knob. The area is not highly visible from other major landmarks on the District because it is surrounded by high ridges. Only a small portion adjacent to State Road 518 is visible from a major travelway. This portion is a steep hillside consisting primarily of lands not suited for timber management. In the eastern half of the diversity unit there is little Aspen and what is there is being overtapped and shaded out by conifers. The western half of the diversity unit contains most of the Aspen stands which provide visual diversity. These stands are just beginning to be overtapped by the conifer trees which regenerated after Aspen sprouting. Most of the Aspen stands within this half of the diversity unit are not in danger of being replaced by conifer for another 40 to 60 years.

## DESIRED FUTURE CONDITION

**VISION:** The forest is visually attractive, and while providing for the various demands and needs, it appears natural.

Manage the visual resources on the Forest according to the Visual Quality Objectives listed on the inventory maps.

Utilize forest management activities to increase visual variety (LR1986.1, page Visual-1)

## NEED FOR ACTION

Action is needed to complete management activities, including timber harvest, while improving or maintaining a high degree of visual quality.

## ISSUE

Some feel that harvesting activities and associated road construction will significantly impair the visual quality of the area.

Harvest activities may present an opportunity to improve future visual diversity within the analysis through the sprouting of Aspen from harvest activities.

## SOCIOECONOMIC IMPACTS

### PAST AND PRESENT CONDITIONS

National demand for wood products has increased significantly during the past four decades. The United States uses more wood products than any other nation. There are several local businesses which provide wood products for construction, fuel, or furniture making. Regionally, there are large corporations who provide construction lumber to the national market. These small and large businesses employ local and regional residents to produce, transport and process these wood products. A majority of local residents in the communities served by the Camino Real District depend upon wood to heat their homes and in some cases cook with. Timber sales have historically provided a large portion of the personal use firewood. Many local residents depend upon the Forest Service to provide personal use wood products such as vigas and latillas which allows them to save money by obtaining the products and processing the wood products themselves.

### DESIRED FUTURE CONDITIONS

"**LOCAL NEEDS AND DESIRES...** The management of the Carson can affect the various lifestyles of local residents through the activities and products it produces. As with National and Regional needs for products and activities, the Forest will be sensitive to these local needs and desires. Specific responses will be documented in the standards and guidelines in this Forest Plan.

**RESPONSIVE...** The Forest will not try to artificially structure or set lifestyles or economic factors. It will follow the lead of the public as expressed through their demands for Forest products and activities. The intent will be not to have quick or massive changes" (LR1986.1, page A Carson Overview - 3).

## NEED FOR ACTION

We need to consider the economic and social impacts this proposed sale will have on local and regional people and economies.

ISSUE	The decision may affect the availability of wood products available to local and regional people and economies.
-------	---

## ECONOMIC EFFICIENCY

### PAST and PRESENT CONDITIONS

Generally, timber sales on the Carson National Forest cost more to plan, prepare, and implement than the amount of money generated from the sale of the timber. A large amount of the cost is attributable to the planning process which is driven by the laws in the National Environmental Policy Act and the National Forest Management Act. These laws ensure that agency planning processes involves the public in our decisions and evaluate the impacts our proposed actions have upon the human and natural environment. The Forest service is not mandated to generate a positive cash flow on timber sales. Our mandate is to provide a wide range of goods and services to the American people while protecting and conserving our natural resources on National Forest lands. Although we are not mandated to generate a positive cash flow, we are responsible for being as cost effective as possible in carrying out our mission.

### DESIRED FUTURE CONDITION

"The intent of management is to promote dependent user stability through direct supply of products such as wood and forage and to provide community stability and enjoyment through the direct or indirect supply of products and other opportunities. Management practices should provide the best cost-benefit results as well as protect resources" (LR1986.1, page A carson Overview - 4).

### NEED FOR ACTION

To ensure to our customers, the American people, that we are considering the economic cost of our proposed actions and disclose these costs openly.

To ensure cost is considered in the decision making process.

### ISSUE

Some feel that we should not be allowed to offer timber sales which do not produce a positive cash flow. Others feel that ensuring adequate resource protection and providing products locally, regionally, and nationally is more important than cost.

### BACKGROUND

The position statement for the Angostura timber sale was developed in 1985 (IO1985.1). Initial public scoping started in January 1989 (CN1/12/89). Data collection and analysis were conducted from 1986 through August 1992. The Forest Supervisor issued a Notice of Intent to prepare an Environmental Impact Statement on the Angostura Timber Sale on February 21, 1992 (CN2/21/92).

Consultation and public involvement was sought in 1989, 1990, 1991, and 1992. Two open houses, several meetings, press coverage, and letters to interested publics afforded people an opportunity to comment (CN1/12/89, CN3/1/89.2, CN3/17/89, CN3/18/89, CN7/3/89.1-7, 4/2/91.3, 4/6/91, CN2/21/92, CN4/23/92). Eight people attended two open houses, 28 letters were received, and numerous verbal comments were made in person or via telephone. Comments received related to:

- FR 89 Use
- Old Growth
- Recreation
- The Decision-making Process
- Fire
- Soil and Water
- Wildlife Habitat
- Wildlife
- Livestock
- Cultural Resources
- Vegetative Diversity
- Economics/Cost
- Manner of Harvest
- Level of Harvest
- Past Harvest Practices
- Disturbance of Wildlife
- Wilderness
- Threatened and Endangered Species

All comments received throughout this analysis were...

- ...incorporated in the issues, or
- ...covered by mitigation measures (see Chapter 2 Alternatives), or

- ...are beyond the scope of this project to address.

Those comments that could not be readily addressed were grouped into "issues." Alternative ways were

developed and analyzed to deal with the issues. Each issue can be more fully understood by reading Chapter 3 Affected Environment and Environmental Consequences.

## DECISIONS TO BE MADE

- Should a timber sale(s) be used to help achieve the desired future condition?
- If so, which areas in the Angostura analysis area should be harvested and what vegetation conditions should be created in the harvest areas?
- What products should be offered (sawtimber, firewood, vigas, poles) and how much?
- Should new roads be constructed? If so, what location and how many miles?
- What, if any, roads should be obliterated or closed?
- Which areas should be thinned?
- Which areas should be allocated to old growth?
- What kind and how many wildlife improvements should be developed?
- What kind and how many watershed improvements should be developed?

## 2. ALTERNATIVES

### ALTERNATIVE DEVELOPMENT

This section describes the alternatives that were developed as a result of addressing issues which were identified from scoping efforts. The issues were identified as a result of public involvement (open houses, field trips, meetings etc.) and resource specialist information. These issues serve as the objectives and framework around which the alternatives are developed.

#### **Vegetation Diversity**

The Team developed alternatives which focused on increasing vegetative diversity within the analysis area on lands classified as suitable for timber harvest. Current existing vegetation conditions were compared with the objectives in the Forest Plan regarding desired future vegetation conditions. A range of alternatives were then developed to reflect meeting Forest Plan objectives at varying levels.

Alternatives were developed to increase the acres in the early successional vegetation stages as there are currently very few acres in the 0-40 year age class. This early successional vegetation condition provides important habitat for many species of wildlife. Generally, wildlife species richness is higher in a forest ecosystem which exhibits a mix of successional stages from early to late stages. Increasing the acres within the 0-40 year age class mimics natural occurrences such as fire and/or insect and disease attacks which created this habitat under natural conditions in presettlement times. The Forest Plan objective is to create a balance of all age classes by distributing an equal number of acres in each age class on lands classified as suitable for timber harvest (LR1986.1, page C.Wildlife & Fish, Table Wildlife-1).

A balance of age classes is difficult to obtain in one treatment entry so alternatives were built around the assumption of several treatment entries over a long period, rather than a one-time heavy treatment. However, each treatment should move closer to that balance.

Depending upon the existing stand condition, there are several silvicultural treatments which can convert mature stand conditions (100-140 year age class) to the 0-40 age condition. In stands which already have established healthy regeneration, removal cuts remove the overstory of mature trees and release already established seedlings in the 10-40 year age class. In stands where there is little to no existing

regeneration established in the understory, regeneration cuts such as seed cuts and group selections create conditions conducive for natural regeneration which creates the beginning of the forest growth and development cycle.

#### **Old Growth**

Special emphasis was placed on old growth. The Carson Forest Plan says, "We focus on the forest -- a total ecological system -- a recycling system. A key to the sustainable forest is old growth. We will manage old growth to provide the following values: blueprint and sustainability; habitat diversity, recreation and aesthetics; opportunities for spiritual nourishment; high quality products" (LR1986.1, page C.Sustainable Forest-1).

Old growth provides for the late successional vegetation stage habitats in the forest ecosystem. Just as the early successional habitat is a critical component for a healthy ecosystem, the late successional habitat is equally important.

Because the Angostura analysis area contains approximately 2,900 acres within Management Area 20 (Semi-Primitive), alternatives were developed which exceeded the 18% minimum old growth allocation.

In developing the old growth allocations for each alternative, particular attention was given to allocating those stands which currently met or was close to meeting old growth definitions in the Forest Plan.

Although old growth allocations were only made in the Angostura analysis area, the analysis reviewed the existing and potential old growth within all of the adjacent diversity units (Diversity Units 4, 7, 10, and 17). Existing and potential old growth was identified using site specific stand exam information where such information existed and the Forest old growth inventory where more detailed information was not available.

The following criteria were used to generate all old growth alternatives: 1) allocate the best existing and the best potential old growth stands first, prior to selecting stands for harvest; 2) allocate healthy stands, since they can retain old growth characteristics longer; 3) allocate large contiguous blocks of at least 100 acres so that the allocations are more bene-

ficial to wildlife; 4) allocate a good blend of all vegetative types (mixed conifer and spruce-fir).

### **Water**

Implemented best management practices to mitigate impacts. Each of the action alternatives results in varying levels of revenue generated from the sale of sawtimber and other forest products. A portion of this revenue will be re-invested in the area to reduce existing erosion problems occurring on the old roads originally built by the Santa Barbara Pole And Tie Company in the early 1900's.

### **Forest Health**

To help reduce the spread of dwarf mistletoe, alternatives were developed to remove severely infected overstory trees. Also, infected understory trees would be thinned to reduce the infection and to increase the growth and vigor of the residual trees in the stand. Alternatives were developed to create stand conditions which lower the risk for a major spruce bark beetle or spruce budworm epidemic occurring, primarily by increasing age class and canopy cover diversity and increasing growth and vigor of residual trees.

All stands within the Angostura analysis area would be given a silvicultural priority for treatment based on the severity of the insect and disease infections in the stand and the condition of the stand. This information was obtained from stand exams and field reconnaissance. In each alternative, high priority stands were given priority over other stands for treatment when treating that stand did not conflict with achieving the other objectives of that alternative.

### **Roads**

Alternatives were developed which considers different ways to access the analysis area. There were three logical routes considered which accessed the area from different points.

Alternatives were developed which varied in the miles of road construction and reconstruction needed to remove forest products resulting from vegetation management activities.

## **ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY**

The interdisciplinary team considered a wide range of alternatives in order to assess the reasonableness of the alternatives to be considered in detail. Those

### ***Threatened, Endangered and Sensitive Species***

The upper reaches of Angostura Creek within the diversity unit has a healthy population of native cutthroat trout which is a Forest sensitive species. Spotted owl, Boreal owl, Pine marten, and Goshawk inventories have been conducted within the analysis area but none of the species were found.

The analysis concentrated efforts on mitigation to minimize impacts upon habitat.

### **Wildlife Habitat**

In most cases, increasing the early successional vegetation conditions improves the habitat capability for wildlife species provided that the distribution of the foraging areas and the cover (shelter) areas are favorable. Alternatives were developed which create varying levels and distribution patterns of early successional stage habitat.

### **Recreation Experience**

Concentrated on mitigation to minimize impacts to ongoing recreation activities within the analysis area.

### **Visual Quality**

Concentrated on mitigation measures to minimize visual impacts. Some silvicultural treatments may affect visual quality more than others. Alternatives were developed which propose different silvicultural prescriptions to attain vegetation diversity goals.

### **Socioeconomic Impacts**

Some people living within the communities served by the Camino Real Ranger District make their living working in the wood products industry. Firewood produced from the harvesting of timber is an important and necessary commodity within these communities. Alternatives were developed to produce varying levels of forest products.

### **Economic Efficiency**

Two of the major factors that determine the economic efficiency is the quantity and price of sawtimber produced from vegetation management activities and the cost of the associated road construction. Alternatives were developed to produce varying levels of sawtimber and associated road construction. The Forest Plan lists 8 million board feet as a possible sawtimber offering (LR1986.1, page timber-6).

alternatives eliminated from detailed consideration, along with the rationale for their dismissal, are as follows:

- An alternative was considered in which the roads constructed under the action alternatives would be permanent roads and would become a part of the District road system instead of being closed following vegetation management activities. This alternative was dismissed from detailed consideration because the unroaded character of the Diversity Unit is unique in comparison to the rest of the District, and the unroaded character should be maintained. There were many comments from the public during the open houses regarding the desire to maintain the unroaded characteristic of the area.
  - An alternative was considered which would recommend that the Diversity Unit be designated as wilderness. This alternative was dismissed from detailed analysis because it was determined to be outside the scope of the analysis. The area was reviewed for wilderness designation by a Congressional delegation during the development of the New Mexico Wilderness Legislation of 1980. Only Congress can designate wilderness through legislation. Also, the no action alternative discloses the same effects as this alternative.
  - An alternative was considered which would designate the portion of the Diversity Unit outside of Management Area 20 (semi-primitive, non motorized) as part of Management Area 20. This alternative was dismissed from detailed analysis for the same reasons mentioned in the previous paragraph. Also, this issue had been discussed and negotiated previously during development of the Forest Plan. The no action alternative discloses the same effects.
  - An alternative was considered in which fire would be used exclusively to accomplish the vegetation management objectives in the Diversity Unit instead of harvesting, or a combination of fire and harvesting.
- This alternative was dropped from detailed analysis as it did not reflect the Forest Plan objective of providing forest products resulting from meeting vegetative management objectives on lands classified as suitable for timber management. Also, since natural fires have been excluded from the area by fire suppression for the last century, the risk of effectively controlling fire to meet vegetative management objectives while adequately protecting the other resources is considered to be too significant and uncertain.
- An alternative was considered in which the forest products resulting from vegetation management would be harvested using helicopter logging techniques as opposed to conventional tractor logging. The Region 3 logging specialist visited the District in April of 1992 to determine the operational and economic feasibility of helicopter logging. One of the helicopter logging alternatives considered would harvest the available acres which could be accessed without any additional road construction or reconstruction. Another alternative considered harvesting acres which could be accessed by minimal road construction and reconstruction. In both cases, the alternatives were determined not to be economically feasible, primarily because of the high elevation of the area which drastically restricted helicopter payload capacities.
  - An alternative was developed which was very similar to alternative G. To avoid redundancy, this alternative was subsequently dropped and another developed in its place (alternative D).
  - An additional access route was explored which originated through Agua Piedra Campground. This access alternative was subsequently dropped because it was determined not to be feasible because of slope and distance restrictions.

## ALTERNATIVES

The alternatives include a no action alternative and six harvesting alternatives that respond to the needs for action and issues (see chapter 1 Purpose and Need). Details of the alternatives in chart form follow a brief listing of important distinctions of each alternative.

### ALTERNATIVE A (No Action)

- Timber will not be harvested, maintain current level of management.
- No new road construction will occur.
- There will be no old growth allocated.
- No forest products made available.
- No firewood would result from harvest activities.
- Some dead and down firewood is currently available.

### ALTERNATIVE B

- Harvest on approximately 623 acres in 1994 to create additional early successional habitat to improve current diversity, control insects and disease, and improve overall forest health while protecting and benefiting other resources. Vegetation diversity objectives will be met throughout all portions of the diversity unit with harvest units well distributed throughout the diversity unit.
- Construct 12.5 miles of minimum specification roads. Construction will originate from the current end of Forest road 161. Roads will be closed after forest products have been removed and will subsequently be used as recreational trails.
- Allocate to old growth two large blocks in management area 20, a large block in the southeastern portion of the diversity unit which connects to one of the blocks in management area 20, a block adjacent to Agua Piedra Campground and another block just below Ripley Point.

### ALTERNATIVE C

- Harvest approximately 945 acres in 1994 to create additional early successional vegetation to improve current biodiversity, control insects and disease, and improve overall forest health while protecting and benefiting other resources. Above objectives will be met throughout all portions of the diversity unit with harvest units well distributed throughout.
- Construct 12.0 miles of minimum specification roads which would originate from the current end of Forest road 89. Existing Forest Road 89 would be reconstructed and widened. Roads will be closed

after forest products have been removed and will subsequently be used as recreational trails.

- Old growth allocation primarily in the spruce-fir forest type in the southeastern portion of the diversity unit to connect with the large blocks in Management area 20. One large block of the mixed conifer forest type would be allocated between the Rio Pueblo and Knob Creek.

### ALTERNATIVE D

- Harvest on approximately 700 acres in 1994 to create additional early successional vegetation to improve current biodiversity, control insects and disease, and improve overall forest health while protecting and benefiting other resources. Diversity objectives would be met in all portions of the diversity unit with emphasis within the spruce-fir forest type.
- Construct 11.0 miles of roads originating from the current end of Forest road 161. Roads will be closed after forest products have been removed and will subsequently be used as recreational trails.
- Old growth allocation would consist of two large blocks within management area 20, A large block above Agua piedra campground, another block between the Rio Pueblo and Knob Creek, and a block adjacent to Angostura Creek and trail 493.
- Depend primarily upon the group selection silvicultural prescription to meet diversity goals within the spruce-fir forest type.

### ALTERNATIVE E

- Harvest on approximately 660 acres in 1994 to create additional early successional vegetation to improve current biodiversity while protecting and benefiting other resources.
- Minimize the necessary road construction by concentrating harvest activities within the southeastern 1/4 of the diversity unit, restricting harvest to the spruce-fir forest type. Roads will be closed after forest products have been removed and will subsequently be used as recreational trails.
- Construct 6.5 miles of roads originating from the current end of Forest road 89. Reconstruct and widen 1.5 miles of existing Forest Road 89.
- Old growth allocation is similar to alternatives B and C.

### ALTERNATIVE F

- Harvest on approximately 860 acres in 1994 to create additional early successional vegetation to improve current biodiversity, control insects and dis-

ease, and improve overall forest health while protecting and benefiting other resources.

- Reduce necessary road construction by concentrating harvest activities within the southeastern 1/4 of the diversity unit and the high risk budworm and dwarf mistletoe stands just east of the Knob.
- Construct 10.5 miles roads originating from the current end of Forest road 89. Reconstruct and widen 1.5 miles of existing Forest Road 89. Roads will be closed after forest products have been removed and will subsequently be used as recreational trails.
- Old growth allocation is similar to Alternative D.

#### **ALTERNATIVE G**

- Harvest in 1994 on approximately 1,620 acres to maximize achievement of diversity goals in the shortest time period, control insects and disease, and im-

prove overall forest health while protecting and benefiting other resources. Harvest activities are distributed throughout the entire diversity unit

- Construct 17.5 miles of roads originating from the end of existing Forest Road 161. Roads will be closed after forest products have been removed and will subsequently be used as recreational trails.
- Old growth allocation is similar to alternative D.

#### **PREFERRED ALTERNATIVE**

At this point in time Alternative G is considered the preferred alternative with one addition, and that is that the access point into the analysis area be from the north via Forest Road 89 versus coming from the south via Forest Road 161.

Table 4. COMPARISON OF ALTERNATIVES

	ALT A	ALT B	ALT C	ALT D	ALT E	ALT F	ALT G
<b>HARVEST</b>							
...Acres	0	623	945	696	661	856	1620
...% of Diversity Unit	0	6	9	7	6	8	16
...% of Suitable Lands	0	14	21	15	15	19	36
<b>SPECIES COMPONENT</b>							
...Spruce-Fir Harvest (acres)	0	392	700	558	661	762	1,130
...Mixed Conifer Harvest (acres)	0	145	145	81	0	37	258
...Aspen Harvest (acres)	0	86	100	57	0	57	232
<b>HARVEST TYPE (acres)</b>							
...Group Selection	0	145	110	315	87	63	87
...Removal	0	170	405	0	374	518	1091
...Seed Cut	0	64	172	0	0	45	115
...Individual Tree Selection	0	200	200	200	200	200	200
...Thinning from Above&Below	0	0	0	169	0	0	42
...Patch Clearcuts (Aspen)	0	44	58	12	0	30	85
<b>NET VOLUME</b>							
...MBF	0	2,600	4,200	3,200	3,100	3,100	6,900
...MBF/acre	0	4.2	4.4	4.6	4.7	3.6	4.3
<b>MISTLETOE &amp; SPRUCE BUDWORM TREATMENT</b>							
...acres	0	187	201	126	0	90	300
...Priority Acres Treated (%)	0	26	28	18	0	13	42
<b>SPRUCE BEETLE TREATMENT</b>							
...Acres Treated	0	392	700	558	661	762	1,130
...% of Spruce Component	0	7	12	10	12	14	20
<b>OLD GROWTH ALLOCATION</b>							
...acres	0	2,950	2,450	2,600	2,875	2,690	2,735
...% forested acres in Analysis Area	0	34	28	30	33	31	31
...% of Suitable	0	65	54	57	63	59	60
<b>ROADS (miles)</b>							
...Existing	1.5	1.5	1.5	1.5	1.5	1.5	1.5
...New Construction (miles)	0	12.5	12.0	11.0	6.5	10.5	17.5
...Reconstruction (miles)	0	0	1.5	0	1.5	1.5	0
...To Be Closed	0	12.5	13.5	11.0	8.0	12.0	17.5
...To Be Obliterated	0	0	0	0	0	0	0
...Open After Sale	1.5	.75	0	.75	0	0	.75
<b>ROAD DENSITY (miles/sq mile)</b>							
...Prior to Sale	.09	.09	.09	.09	.09	.09	.09
...During Sale	n.a.	.77	.73	.95	.60	.65	1.11
...After Sale	.09	.04	0	.04	0	0	.04
...Access Point	n/a	FR161	FR89	FR161	FR89	FR89	FR161
<b>POST-SALE TREATMENTS</b>							
...Personal Use Firewood (cords)	0	2,725	3,855	2,275	2,325	1,875	6,835
...Aspen firewood cutting (acres)	0	44	50	12	0	12	92
...Aspen firewood cutting (cords)	0	360	385	96	0	96	697
...Spruce Vigas (#)	0	7,000	7,000	7,000	7,000	7,000	7,000
...Pre-commercial Thinnning (acres)	0	130	375	175	340	450	980

Alternatives B, C, D, E, F, & G include 200 acres of commercial thinning from below treatment. The thinning from below will reduce the competition for water and nutrients between trees and improve growth rates of the remaining trees. This treatment will be accomplished adjacent to proposed roads and the cut trees will be offered as personal use and/or commercial vigas.

Small patch clearcuts under 5 acres will be done to regenerate new aspen trees from the roots of the existing trees (aspen very seldom regenerate from seed) primarily to provide browse for wildlife but also maintain vegetative diversity and scenic qualities. The number of acres to be harvested and cords produced vary for each of the alternatives B, C, D, F, G. The harvests would be planned as personal use and/or commercial firewood sales.

All alternatives will enable residents to gather slash as firewood.

Pre-commercial thinning would be done only in the stands that would be harvested, and it would be done after the logging. By doing the thinning after the completion of the logging, the prescriptions can be modified to account for the spacings left after harvesting. These thinnings will remove small excess trees and allow residual trees to grow faster.

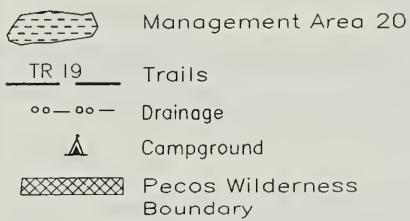
The action alternatives will treat anywhere from 7 percent to 17 percent of the forested acres in the analysis area.

Following are maps of each alternative. They show where harvesting would take place, which areas will be allocated to old growth, and the final road network that would be utilized by each alternative to remove forest products. It needs to be noted here that road locations are approximate and will be finalized on the ground.

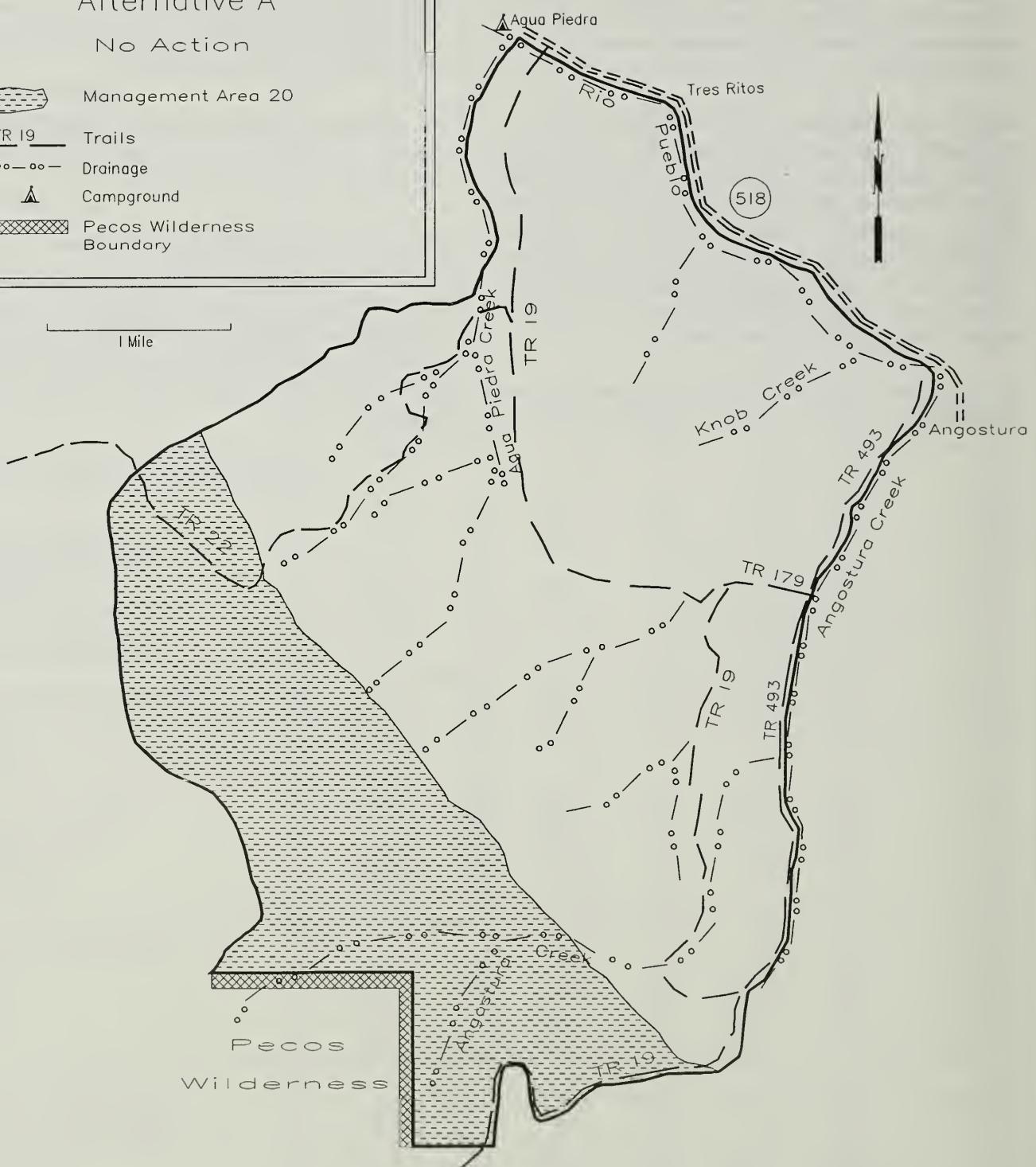
## Angostura Analysis Area

### Alternative A

#### No Action



1 Mile

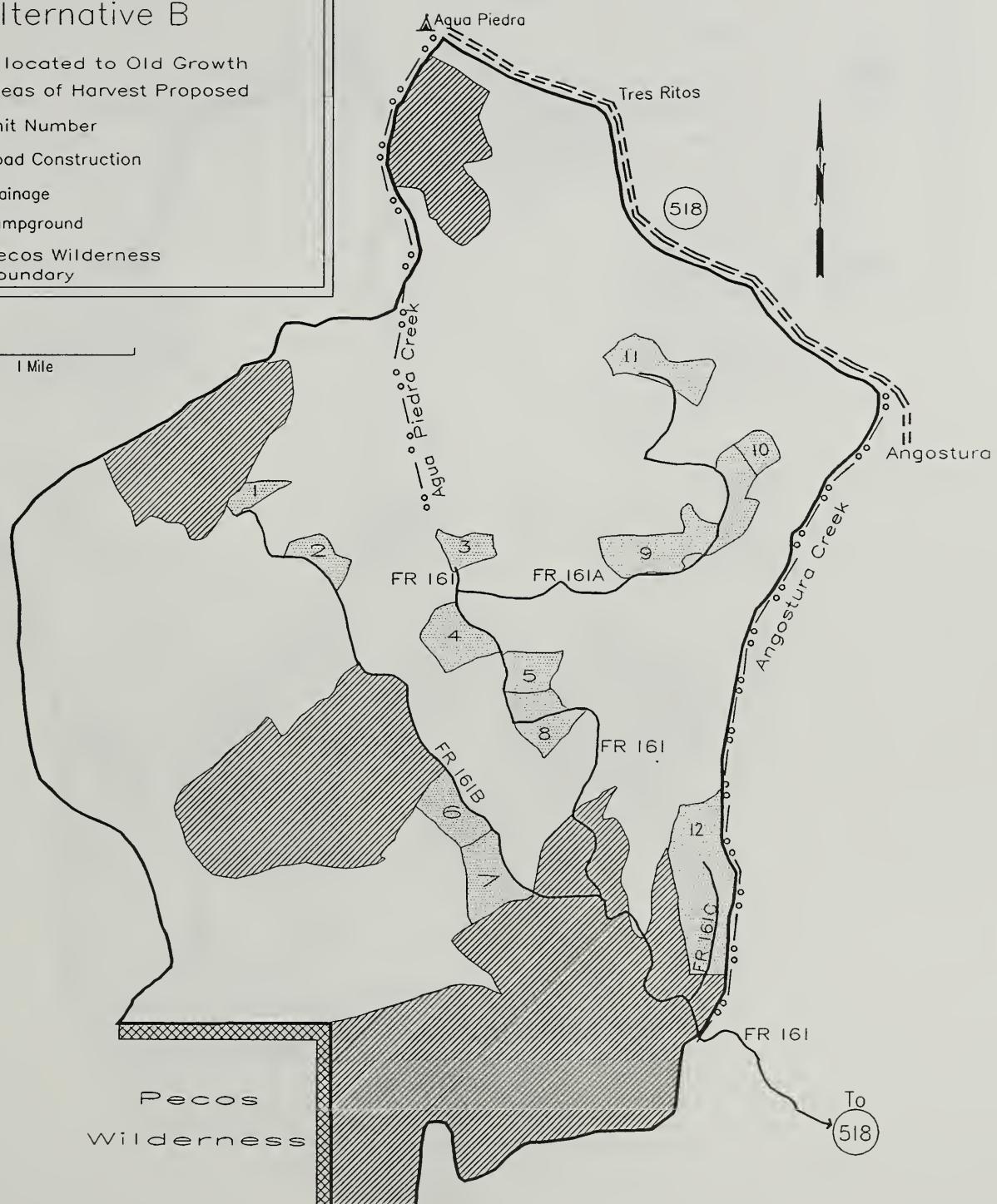


MAP 2

## Angostura Analysis Area Alternative B

- Allocated to Old Growth Areas of Harvest Proposed
- 5** Unit Number
- Road Construction
- Drainage
- Campground
- Pecos Wilderness Boundary

1 Mile



MAP 3

**Angostura Analysis Area**  
**Alternative C**



Allocated to Old Growth



Areas of Harvest Proposed

5

Unit Number



Road Construction



Drainage

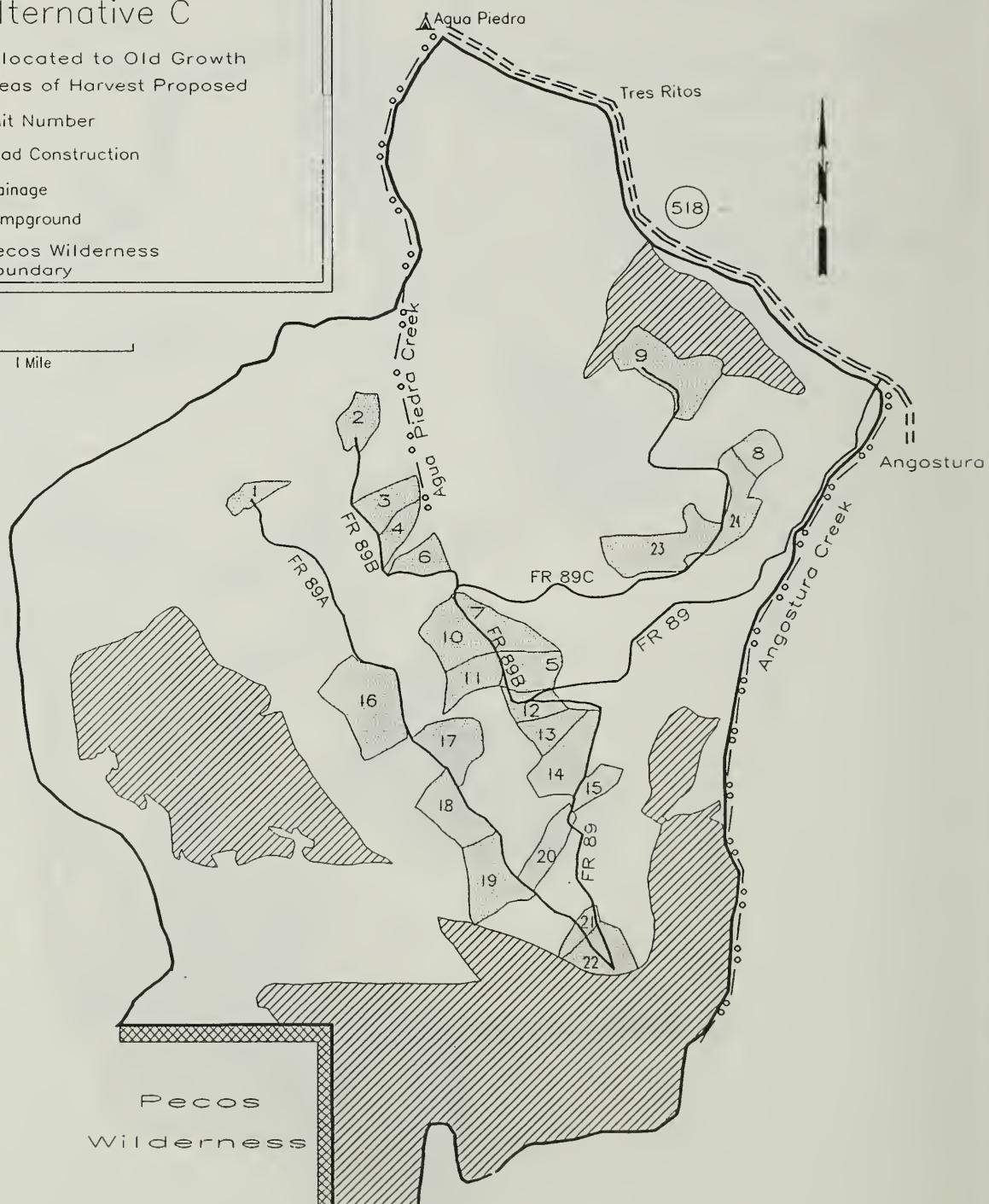


Campground



Pecos Wilderness  
Boundary

1 Mile



MAP 4

## Angostura Analysis Area

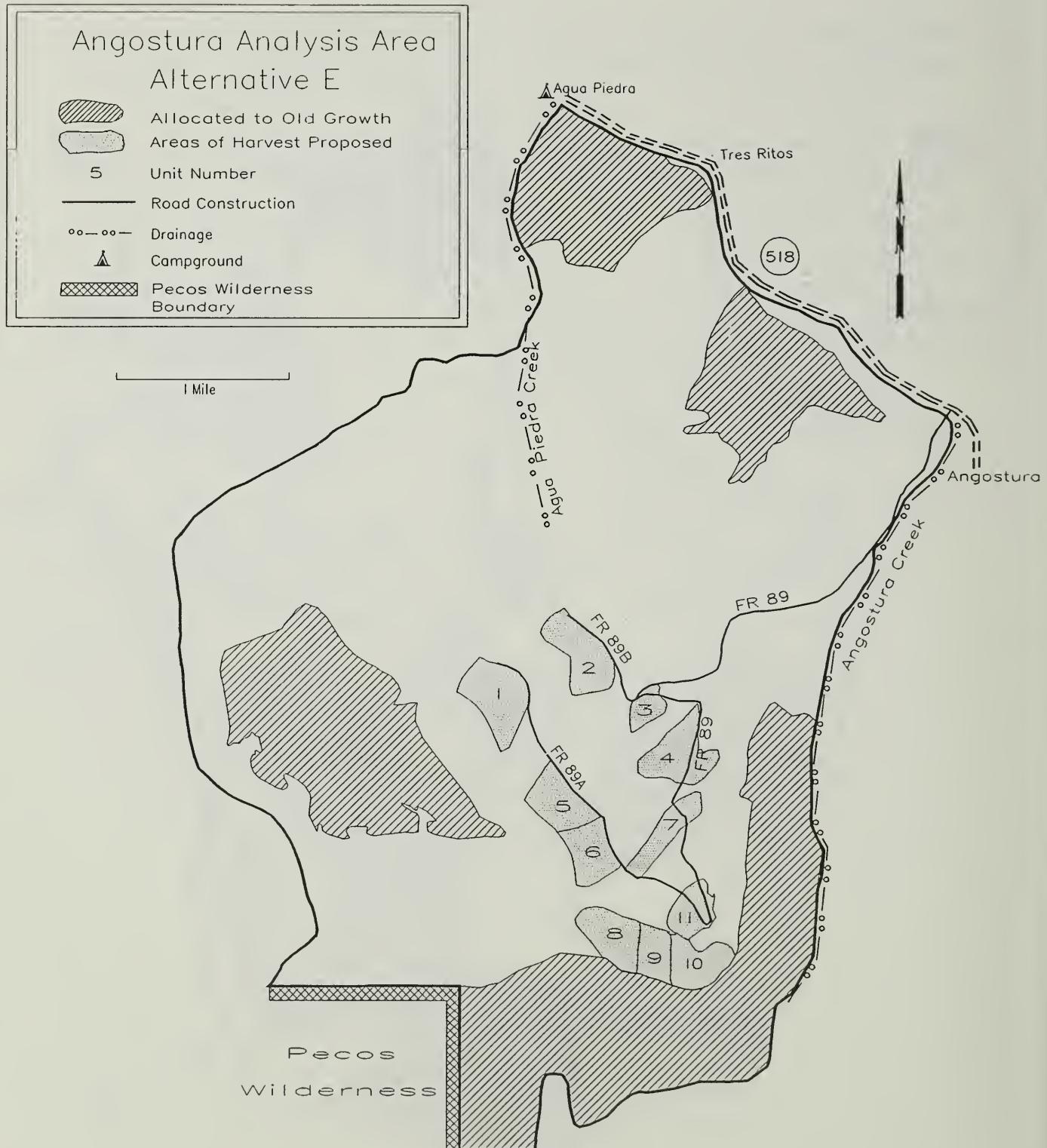
### Alternative D

- Allocated to Old Growth
- Areas of Harvest Proposed
- 5** Unit Number
- Road Construction
- Drainage
- Campground
- Pecos Wilderness Boundary

1 Mile



MAP 5

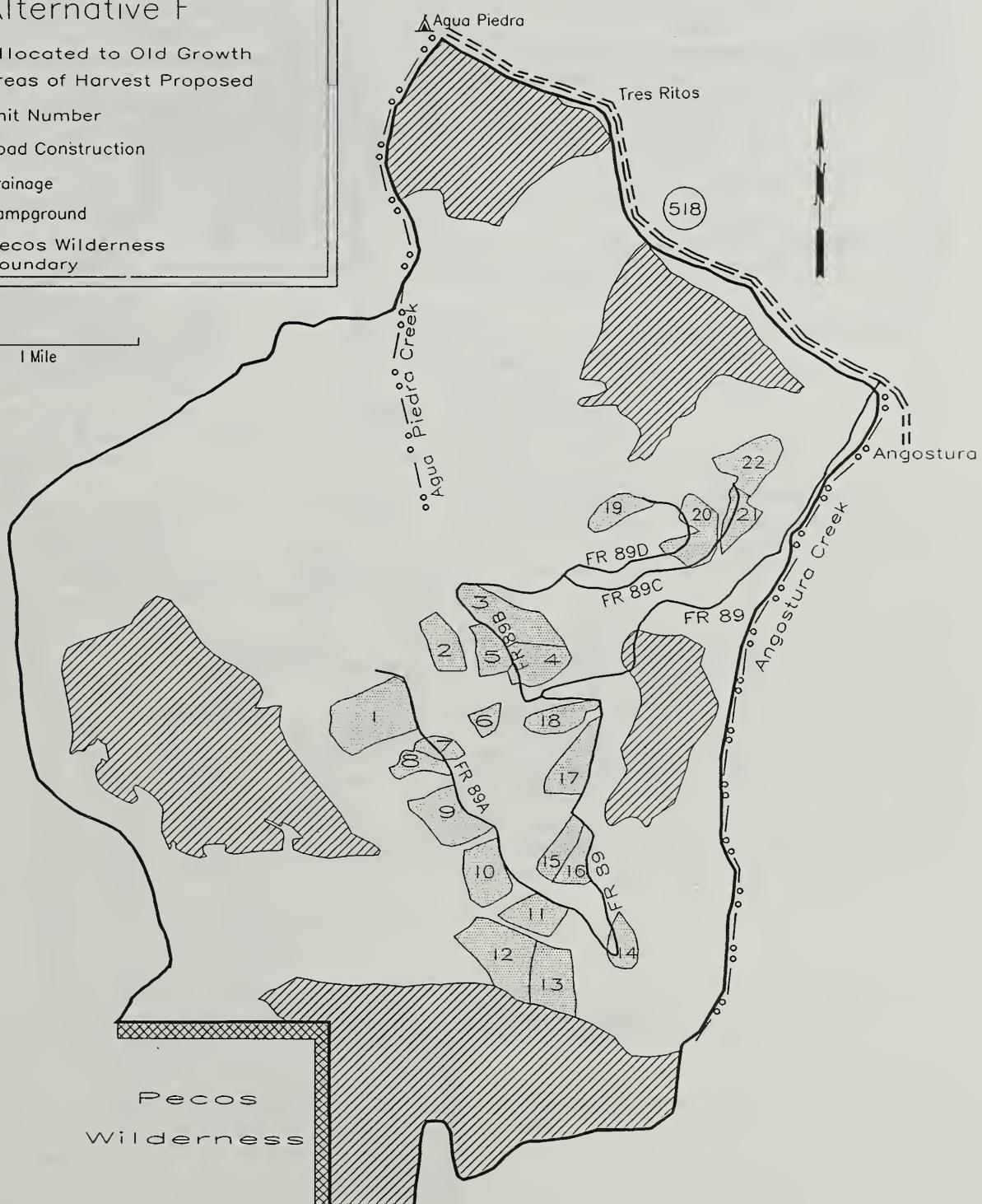


MAP 6

## Angostura Analysis Area Alternative F

- Allocated to Old Growth
- Areas of Harvest Proposed
- 5 Unit Number
- Road Construction
- Drainage
- Campground
- Pecos Wilderness Boundary

1 Mile

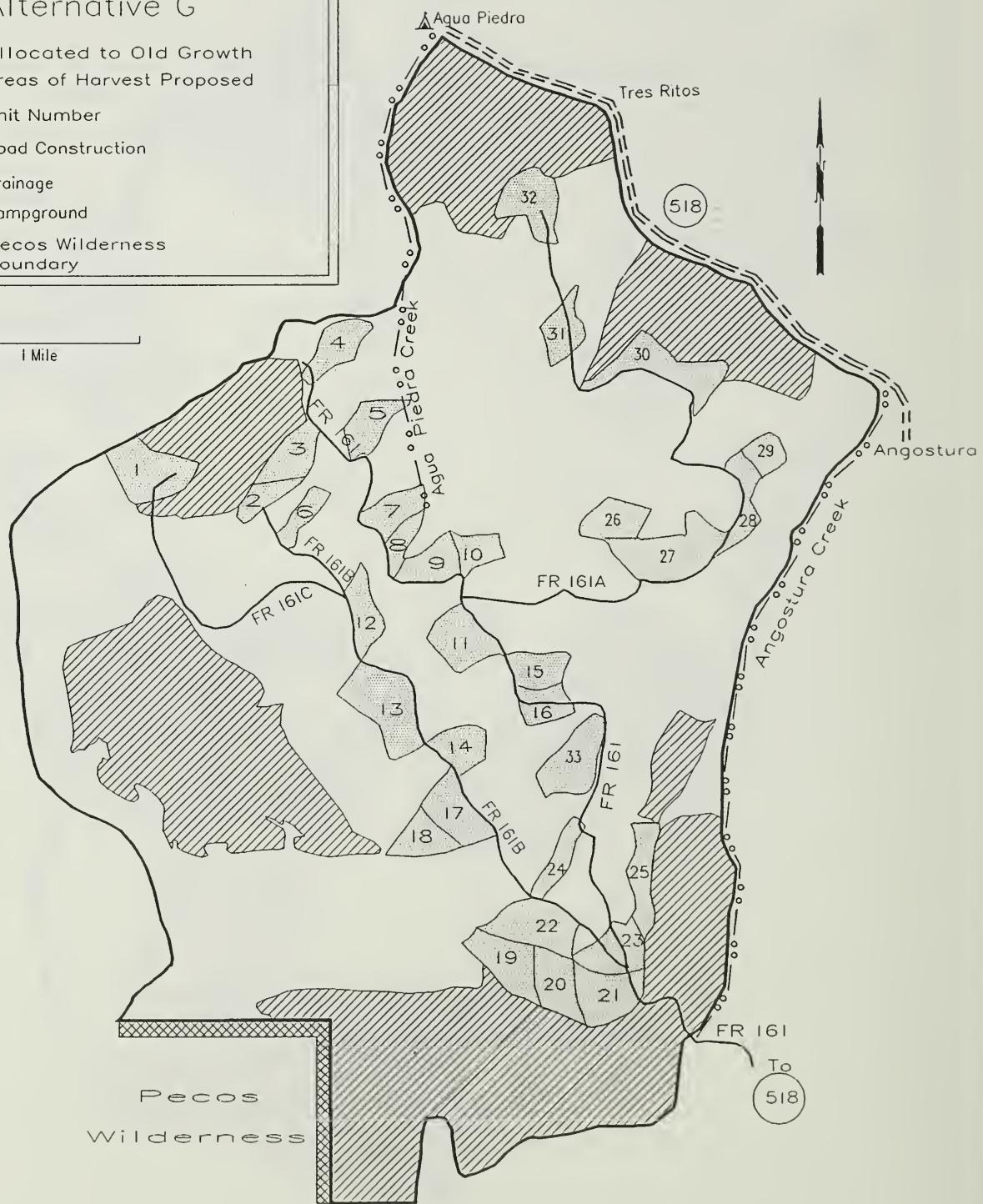


MAP 7

## Angostura Analysis Area Alternative G

-  Allocated to Old Growth
-  Areas of Harvest Proposed
- 5 Unit Number
-  Road Construction
-  Drainage
-  Campground
-  Pecos Wilderness Boundary

1 Mile



MAP 8

To minimize resource impacts, the following mitigation measures would be followed.

**Table 5. Mitigation Measures Common To Alternatives B, C, D, E, F, G**

#	Mitigation	Why
<b>Planning and Other General Considerations</b>		
1	Do not offer any sale in Angostura Diversity Unit until the Dropout timber sale road is closed.	To provide security for wildlife.
2.	Do not offer any sale in Angostura Diversity Unit until collector roads off of FR 161 used in the Alamitos timber sale are closed.	To provide security for wildlife.
3	The "normal operating season" for logging activities will be July 15 to November 15.	To minimize soil erosion.
4	No more than 3 cutting units and/or payment units shall be released for cutting at one time.	To minimize wildlife disturbance and facilitate effective sale administration.
5	The sale area will be made available immediately after sale closure for at least one firewood gathering season (May-December) for personal-use wood gathering.	To reduce the level of fuels present.
6	Timber sale contract administration will be conducted in the field as frequent as possible.	To insure consistent and timely contract provision enforcement and to minimize damage to the resources.
7	During logging operations, slash should be piled at the edge of small created openings from the group selection harvests to provide resting sites for Pine marten.	To protect and enhance potential habitat for Pine marten.
8	Buffers of untreated areas will be left between harvest units and major recreation trails.	To protect visual quality along recreation trails.
<b>Roads</b>		
9	Within two years of the completion of the sale activities, close all existing roads and all newly constructed roads.	To minimize wildlife disturbance.
10	Road construction activities in areas identified as critical such as major drainage crossings will be monitored jointly by the Forest Service engineering representative and the responsible resource specialist. Construction activities in these areas will not be allowed to begin until the appropriate specialists are present on the site.	To minimize impacts to affected resources. To ensure mitigation measures are adequately implemented.
11	A temporary bridge will be used to cross La Sierra Ditch if access is from the end of Forest Road 161, and to cross the Rio Angostura if access is from Forest Road 89.	To facilitate effective closure of the road system following management activities.
12	All roads will be kept closed to the public during the period when harvest activities are occurring through the use of gates located at the temporary bridge. The only period in which public vehicular access will be allowed is the period following harvest activities for firewood gathering, and personal and/or commercial vigas.	Public safety and wildlife security.
13	An open-bottom plate-arch culvert or temporary bridge with concrete footings will be used to cross Angostura Creek and Agua Piedra Creek.	To protect fish habitat.
14	If temporary, short term disturbance is unavoidable in the streambed itself during road construction activities, it should occur during the fall of the year (August, September, or October).	To avoid disturbance during spawning period for cutthroats.
15	Minimize any construction in wet areas and meadows.	To protect soil and water resources.

16	Roads will be designed to avoid "boggy" areas wherever possible. If a bog cannot be avoided by road re-alignment, "french drains" using rock, geotextiles and filter cloth will be used.	To maintain the integrity of the flow regime and hydrologic functions.
17	Stabilize temporary roads.	To protect soil and water resources.
18	Utilize water-spreading ditches.	To protect soil and water resources.
19	Locate water bars so as to divert water into areas with cover or slash.	To protect soil and water resources.
20	Reseed roads when closing them.	To protect soil and water resources.
21	Drain roads prior to the end of the operating season.	To protect soil and water resources.
22	Outslope roads.	To protect soil and water resources.
23	In the vicinity of all stream crossings with a moderate or severe soil hazard rating, surface unsurfaced roads.	To protect soil and water resources.
24	Surface roads when an adequate filter strip is not available between the road and a stream channel.	To protect soil and water resources. (Graveling can reduce the sediment by 70-80%).
25	Drain roads so that the flow is directed into stable areas of vegetation.	To protect soil and water resources.
26	Drain roads immediately before approaches to stream crossings.	Minimize sediment delivery to the active channel area.
27	Treat cut and fill slopes immediately after construction.	To minimize detachment and transport.
28	Maintain the adequacy and integrity of filter strips between the road and the channel.	To protect soil and water resources.
29	Schedule construction and road maintenance activities at times of year that would minimize the risk of detachment and movement of loose material.	To protect soil and water resources.
30	Rip-rap culvert outfalls (or utilize some other means).	To break up flow concentrations.
31	Temporary road locations will be approved by the sale administrator before construction. Treat temporary roads at the end of the logging season even if they will be needed the following season.	To reduce erosion and sedimentation. (Has been used successfully on other National Forest timber sales.)
32	Evaluate all culvert installations for the potential to use raised inlets (raised inlets provide retention of sediment and moisture upstream of the road crossing).	To reduce erosion and sedimentation. (Has been used successfully on other National Forest timber sales.)
33	Drain, stabilize, and revegetate temporary roads.	To minimize impacts to soil and water.
34	Close temporary roads after the designated timber and/or fuelwood is removed.	To minimize impacts to soil and water.

#### Skid Trails and Landings

35	Do not skid down or in stream courses, including ephemeral channels or swales that at times carry flowing water.	To reduce erosion and sedimentation.
36	Skid across streamside management zones and stream courses only at designated crossings and only when it can be done with minimal damage to soils.	To reduce erosion and sedimentation.
37	Designate skid trails on all TES soil units with either a moderate or severe rating for timber harvest.	To reduce erosion and sedimentation.

38	Designate for protection all intermittent streams and ephemeral streams with intermittent stream characteristics, perched perennial pools and springs.	To reduce erosion and sedimentation.
39	Treat skid trails as soon as possible after the need for them is completed.	To reduce erosion and sedimentation.
40	Lop and scatter slash on skid trails where beneficial.	To reduce erosion and sedimentation.
41	Avoid skidding during wet conditions on soils with low bearing strength.	To reduce erosion and sedimentation.
42	Operate on TES soil units with low bearing strength only when soil is dry or frozen.	To reduce erosion and sedimentation.
43	Keep erosion control operations current with logging operations.	To reduce erosion and sedimentation.
44	Locate landings to ensure an adequate filter strip between the disturbance and the channel network.	To reduce erosion and sedimentation.
45	Locate landings only on slopes gentle enough to act as a "catchment" for sediment that may wash down the main skid trails into the landing.	To reduce erosion and sedimentation.
46	Try to locate landings approximately 300 feet apart.	To reduce erosion and sedimentation.
47	As soon as possible after use, conduct erosion control seeding.	To reduce erosion and sedimentation.
48	Operators will be required to stay on designated skid trails.	To minimize damage to residual stand
49	Skid trails and landings will be layed out to avoid large squirrel middens whenever possible.	Protect Red squirrel habitat.

#### Marking and Felling

50	Leave decadent and dying trees uncut to become snags.	To maintain wildlife habitat.
51	Group selection harvests are to be designed to retain any active cavity trees larger than 20" in diameter. The created opening, if possible, should be at least 30 feet immediately in front of the cavity to allow a clear flight path to the potential nest tree.	To Protect and enhance potential nesting sites for Boreal owls.
52	Do NOT designate or remove snags unless they pose a safety hazard to logging activities or the general public if they might fall into traveled roadways.	To maintain wildlife habitat.
53	Leave at least two or three large trees per acre in overstory removals in the mixed conifer type.	To maintain wildlife habitat.
54	Fell timber "to the lead" to minimize the need to leave the skid trail system.	To minimize impacts to soil and water.
55	Leave cull logs in place in the woods when identified as such by the tree fellers.	To minimize impacts to soil and water.
56	Avoid designating trees on slopes over 40 percent.	To minimize impacts to soil and water.
57	Group selection harvest units will be designed to avoid squirrel middens whenever possible.	To protect Red squirrel habitat.
58	Lop and scatter slash within TES units 820 and 902.	To minimize impacts to soil and water.
59	Leave at least an average of 35% crown cover within TES units 819, 901, 904, 907 & 911.	To minimize impacts to soil and water.

Thinning		
60	In selected stands (larger harvest units), leave unthinned pockets in the middle of thinning blocks. Thin only in harvest stands.	To provide additional wildlife cover.
61	Thinning slash will be made available as firewood until the access roads are closed in accordance with the road closure directions in this document.	To provide additional opportunities for firewood gathering.
Cultural Resources		
62	Cultural resource surveys for proposed harvest stands have been completed and have received State Historic Preservation Officer's concurrence with the recommendations in the reports of those surveys. Any stands not surveyed will NOT be included in the final preferred alternative.	To provide protection for relics and other features of man's past.
63	Identify and avoid cultural resources within all areas of potential disturbance. Monitor purchaser's activity and conduct post-sale inspections.	To protect and preserve cultural resources.

### **3. AFFECTED ENVIRONMENT and ENVIRONMENTAL CONSEQUENCES**

These chapters have been combined to ease your review. They show the present condition of the Angostura Analysis Area and the changes expected from implementing the action alternatives (Alternatives B - G). The no action alternative (Alternative A) shows the present conditions. In most cases Alternative A also reflects the effects of past actions.

This analysis is tiered under the final Environmental Impact Statement (EIS) (2) for the Carson Forest Plan (1). That document took a broader Forest-wide view. That EIS looks at many of the cumulative impacts of the proposed projects and activities that would be

done to implement the Forest Plan. This analysis supplements the Forest Plan EIS with more specifics relative to this proposed project.

There may be related past, present or future actions that...

- ...are similar (common timing and environment), or
- ...could, in combination with this proposal, have cumulative impacts, or
- ...are connected (proposal may set off other actions, depend upon another action, or be a part of another larger action).

#### **VEGETATION**

Manipulation of vegetation in the action alternatives (B-G) will alter current vegetation conditions by changing age class distribution, and canopy cover.

Even though the Forest Plan Environmental Impact Statement analysis [LR1986.2] studied cumulative impacts, this analysis looked at the specifics of this proposed project.

In analyzing age class and canopy cover, the following past, present, and future actions were reviewed.

- Alamitos Timber Sale (Closed 1992)
- Dropout Timber Sale (Closed 1992)
- Pichaco Timber Sale (Closed 1992)
- Duran Timber Sale (Closed 1990)
- Proposed La Cueva Timber Sale (1994)
- Proposed Alamitos II Timber Sale (1996)
- Proposed Sipapu Ski Area Expansion (1993)

#### **Species Composition** [Vegetation Diversity]\*

Table 6 shows the present vegetative types in the Angostura analysis area. The heading "suitable" refers to acres allocated in the Forest Plan to be managed for timber production. This classification

does not preclude management for other resource objectives.

\*The issues (1 Purpose and Need For Action) define the scope of the concerns about the proposed Felipito Timber Sale. The issues are tied to the discussion with brackets containing the issue title; example -- [Vegetation Diversity].

**Table 6. Vegetation Types (acres) (V3/16/89.2, V8/18/92)**

Vegetative Type	Suitability			
	Suitable	Unsuitable	Total	Percent of Diversity Unit
Mixed Conifer	682	1091	1773	17 %
Spruce-Fir	2996	2643	5639	56 %
Aspen	861	482	1343	13 %
Grassland	n/a	709	709	7 %
Riparian	n/a	86	86	1 %
Talus/Rock	n/a	582	582	6 %
<b>TOTAL</b>	<b>4539</b>	<b>5593</b>	<b>10132</b>	<b>100 %</b>

None of the alternatives proposes to alter the current vegetation types.

### **Age Class and Canopy Cover [V8/18/92, V8/21/92,V10/19/92]**

[Vegetation Diversity]\*

Diversity provides an enriched wildlife habitat and a stability to the forest ecosystem. For this project, age class, and canopy cover were selected to reflect diversity. Therefore, the forested vegetation (8,755 acres) is categorized by age class and canopy cover within each vegetation type.

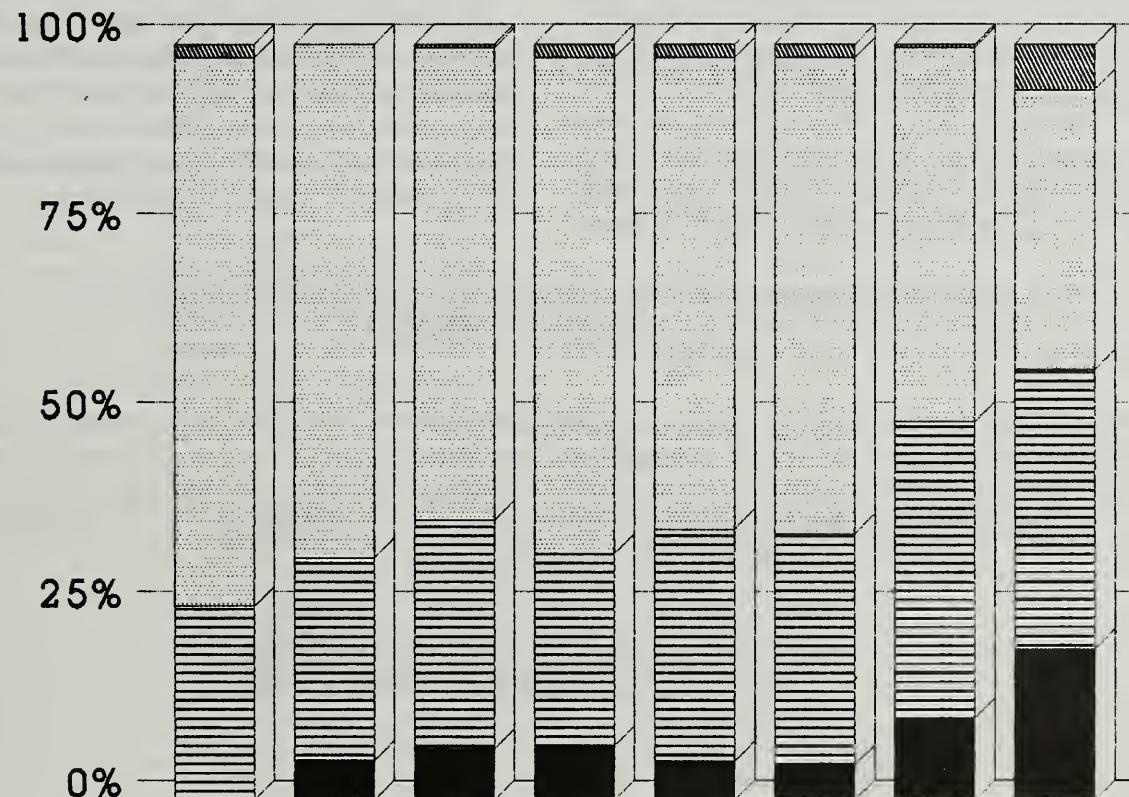
To maintain quality habitat for a variety of wildlife and plant species, habitat needs to be diverse. An elk, a deer, a spotted owl, a cactus, a mushroom all have different habitat needs. Managing all forested land for old growth, for example, would be just as detrimental to maintaining a variety of plant and animal species as harvesting all old growth. There needs to be a balance of age and canopy cover classes distributed all over the forest. Obtaining this balance of age and cover classes is also important in maintaining a continuous sustained yield of forest products. The Forest Plan standards and guidelines for age class distribution and canopy cover were developed from models. The models determined that this age and canopy

structure best provided for all the wildlife species on the forest and was consistent with other uses of the forest (LR1986.1, page Sustainable Forest-7). A balance of age classes can not be obtained in one treatment. However, each treatment should move closer to that balance. The objective, as outlined in the Carson Forest Plan, is to obtain a balance of age and canopy cover classes on 70 percent of the suitable timberlands by the end of the 20th decade (LR1986.1, page Fish & Wildlife-4). Age class distribution and canopy cover is to be monitored by diversity unit.

Tables 7-8 show the age classes distribution on the suitable acres in the Angostura Analysis Area. Table 7 displays how the age class distribution would change in each alternative from the current condition (Alternative A) and how each alternative would compare in reaching the Carson Forest Plan standards and guidelines (1, page C. Fish & Wildlife 4-5).

Table 7. Age Class Distribution, Suitable Acres, Angostura Analysis Area  
Immediately After Treatment

**ALL SPECIES**  
**Suitable Acres Only**



	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G	FP
>160yrs	84	0	20	84	84	84	20	272
81-160yrs	3291	3070	2843	2976	2830	2859	2247	1680
41-80yrs	1164	1210	1368	1152	1388	1383	1782	1680
0-40yrs	0	239	308	327	237	213	490	907



FP = Forest Plan Objective (long term)

The current condition (Alternative A) has an excess of acres in the 81-160 year age class, and is lacking in the 0-40 and the >160 year age classes.

All of the action alternatives establish acres in the 0-40 year age class. Alternative G creates the most early successional stage vegetation conditions followed respectively by alternatives D, C, B, E, and F. One of the surest ways to achieve and maintain diversity is to convert a certain percentage of an area to the early successional stage (0-40 year age class) on each entry. Those stands will then grow through the various age and canopy classes.

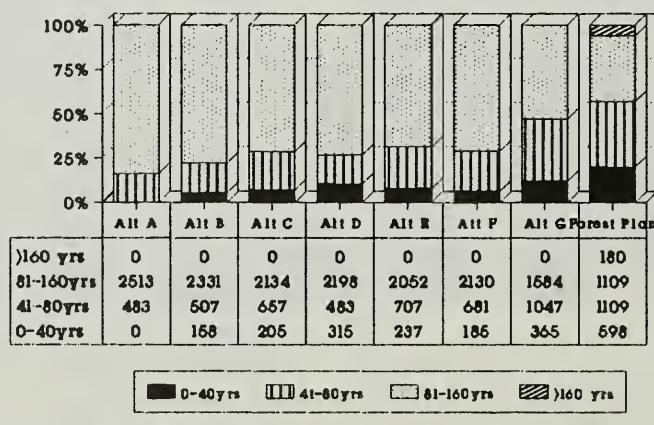
Table 8 breaks out the age class distribution by species (spruce-fir and mixed conifer). The table indicates that both spruce-fir and mixed conifer show a

deficit in the 0-40 and the 41-80 year age classes and a surplus in the 81-160 year age. Spruce fir shows a deficit on suitable lands in the >160 year age class although approximately 20% of the total spruce-fir acres (suitable and not suitable) are classified as existing old growth.

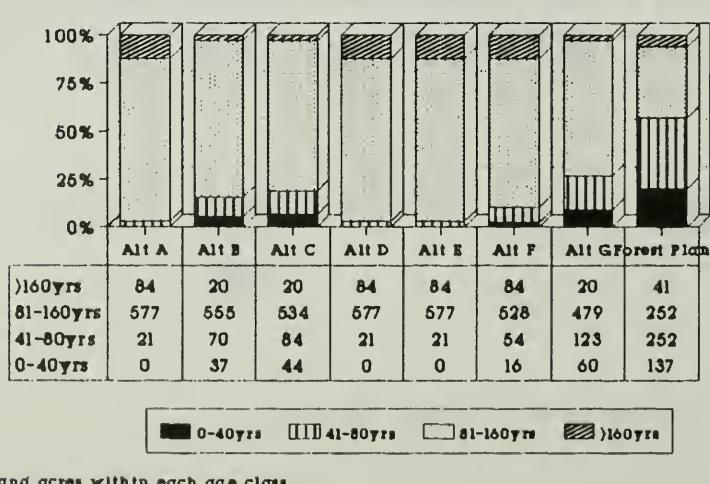
All of the action alternatives come closer to achieving the Forest Plan standards and guidelines for age class distribution than the no action alternative. Alternative G comes closer than all of the other alternatives in meeting the Forest Plan standards and guidelines because it treats more acres in the 81-160 year age class and converts them to the younger age classes. There will still be a shortage of acres in the 0-40 year age class in all alternatives.

Table 8. Age Class Distribution, Suitable Acres, Angostura Analysis Area  
Immediately After Treatment

### Spruce-Fir Suitable Lands Only



### Mixed Conifer Suitable Lands Only



Tables 9-11 show the canopy cover class distribution on the suitable acres in the Angostura Analysis Area. Table 9 displays how the canopy cover distribution would change in each alternative from the current condition (Alternative A) and how each alternative would compare in reaching the Carson Forest Plan standards and guidelines (LR1986.1, page C. Fish & Wildlife 4-5).

Table 9 shows that there is a shortage of acres in the <40% and 40-70% canopy cover classes, and an excess in the >70% canopy cover class in the 41-80 year old stands. All of the action alternatives increase the acres in the <40% canopy cover class. Alternative G meets the Forest Plan guideline in the <40% canopy cover class. None of the alternatives significantly increase the acres in the 40-70% canopy cover class, although this is typical in the spruce-fir type where windthrow risk is moderate to high at densities representing 40-60% canopy cover. Alternative G comes closest to meeting the Forest Plan standards and guidelines in having a balanced amount of acres in the three canopy cover classes, followed respectively by alternatives C, F, E, B, and D.

In the 81-160 year age class, Table 9 shows that there are no acres in the <40% canopy cover class currently and that none of the alternatives create any acres within this class. Again, this is typical, especially within the spruce-fir forest type because of the high risk of windthrow at tree densities representing canopy cover of less than 40%, especially within the saw-timber sized age class.

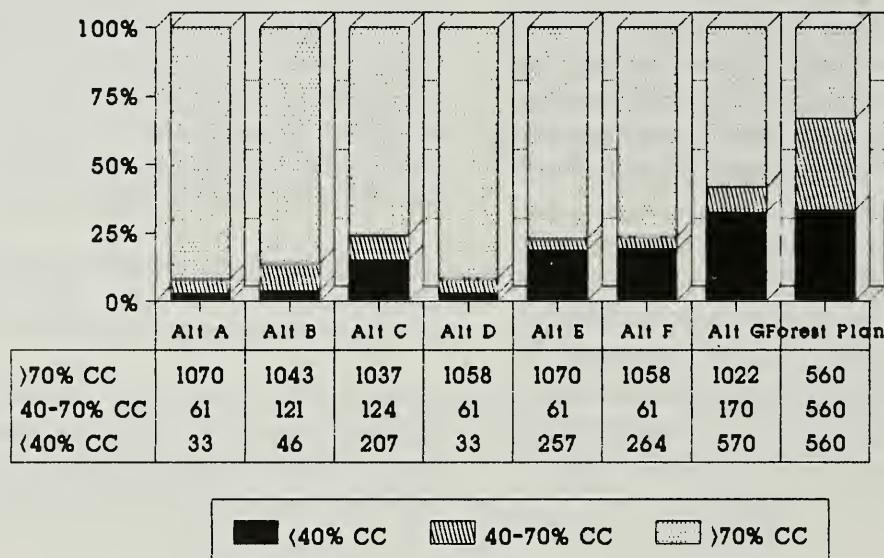
Table 9 shows that the highest percentage of acres remain in the >70% canopy cover in both the 41-80 and the 81-160 year age classes for all action alternatives. The largest reduction in acres from the >70% canopy cover class resulting from the action alternatives occurs within the 41-80 year age class. Alternative G has the best balance of canopy cover classes within the 81-160 year age class, followed by alternatives F, C, D, B, and E respectively.

The canopy cover distribution is broken out for spruce-fir in Table 10 and for mixed conifer in Table 11 and generally show the same trend as Table 9.

All alternatives maintain a minimum of 30% of the acres within the >70% canopy cover class. Alternative G comes closest to meeting Forest Plan objectives regarding crown cover diversity.

Table 9. Canopy Cover Distribution, Suitable Acres, All Species  
Immediately After Treatment

### All Species 41-80 Years Old



### All Species 81-160 Years Old

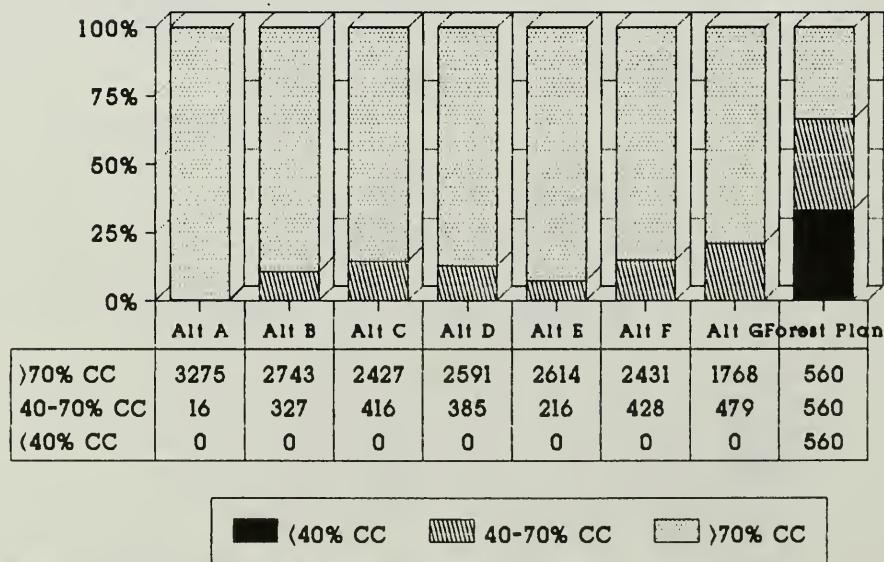
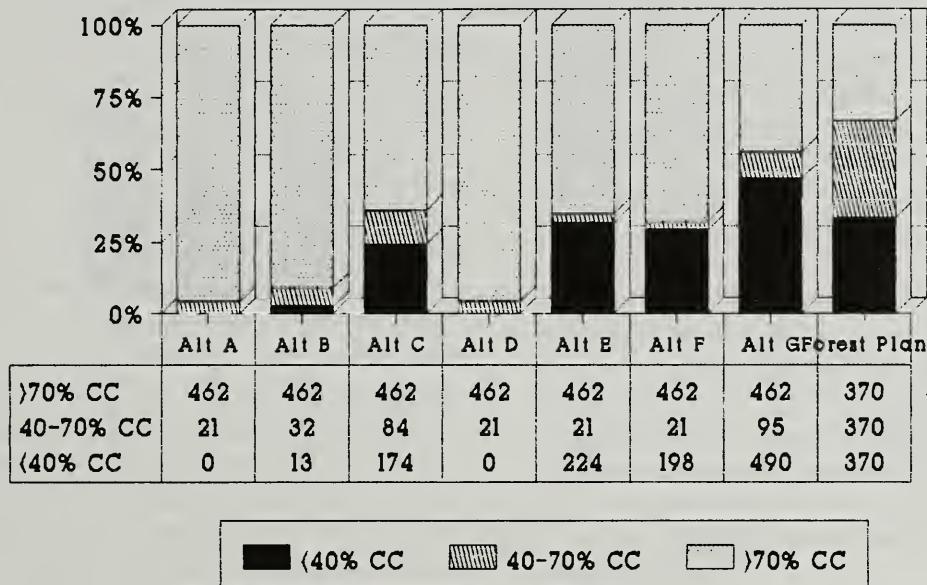
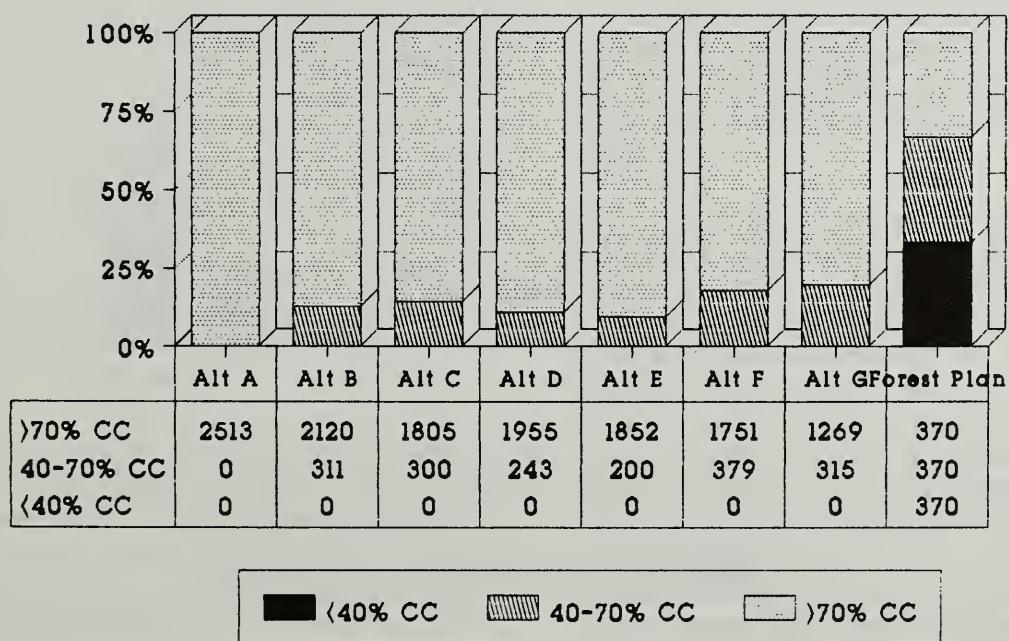


Table 10. Canopy Cover Distribution, Suitable Acres, Ponderosa Pine  
Immediately After Treatment

### Spruce-fir 41-80 Years Old



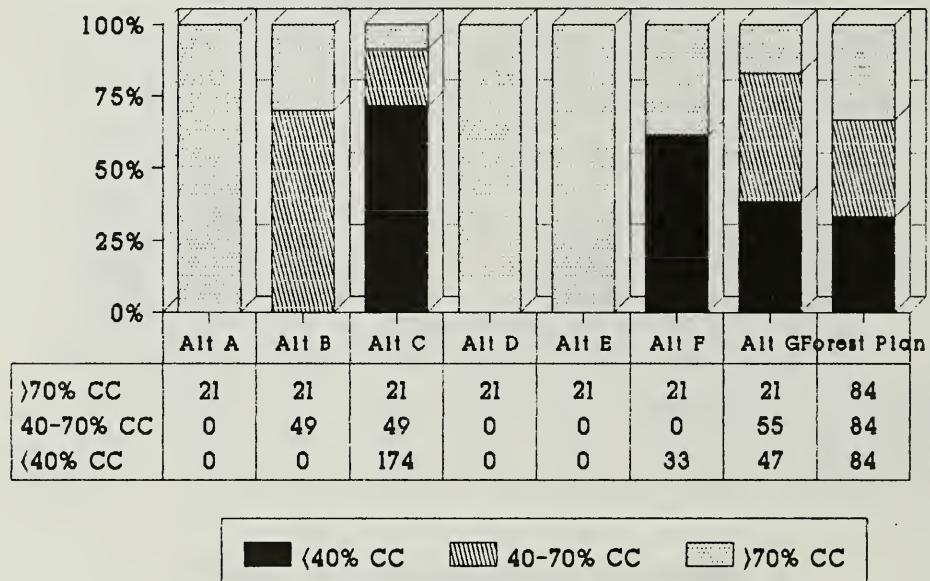
### Spruce-fir 81-160 Years Old



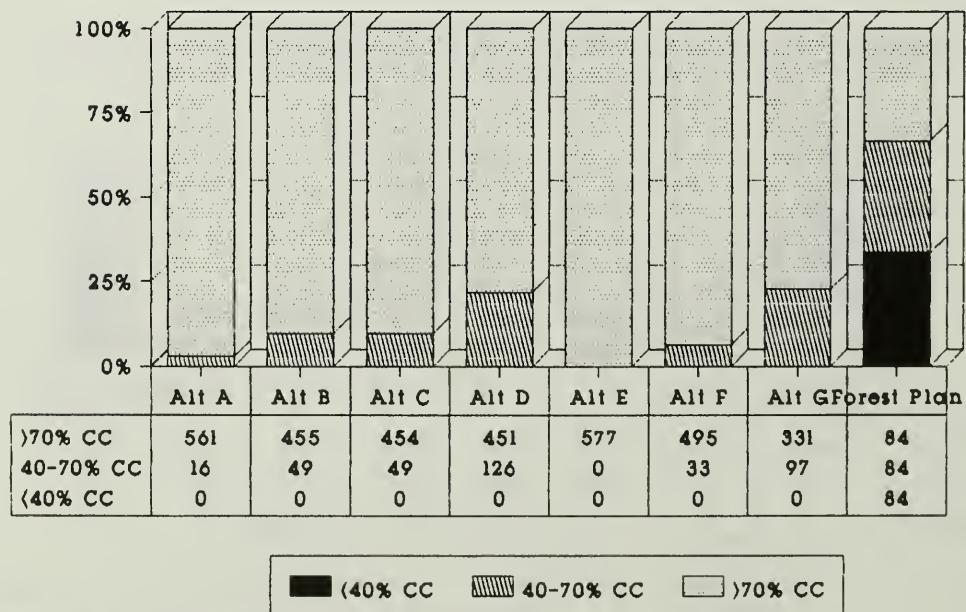
Acres and % within each cover class

Table 11. Canopy Cover Distribution, Suitable Acres, Mixed Conifer Immediately After Treatment

### Mixed Conifer 41-80 Years Old



### Mixed Conifer 81-160 Years Old



Acres and % within each cover class

## Forest Health

[Vegetation Diversity]

Helen Maffei, US Forest Service Plant Pathologist in Central Oregon, recently discussed the health of the forests in Oregon in a report to the Intertribal Timber Council in Albuquerque, NM, on April 10, 1991. She says that the Oregon forests are experiencing epidemic after epidemic, both from defoliators and bark beetles. Each one seems worse than the last. It has taken many years to reach this current decline in forest health. The problem, in general, is that there are simply too many trees. Mainly due to fire suppression, the Oregon forests have more trees than they can sustain. If the trees are not thinned out through management activities, nature will through insects, disease, and wildfire. Forest pests have caused significant growth losses and mortality of many trees. But maybe even more importantly, fuels are building up to record high levels. The risk as well as the frequency of catastrophic fires (which can destroy all vegetation, damage soils, lead to erosion, and cause watershed damage) is increasing rapidly. On the Ochoco National Forest in 1990, for example, sixty square miles of Ponderosa pine forest burned in one wildfire. Policy makers regard the forest health situation as a "world class crisis", and are worried that they may not be able to manage their way out. Oregon Governor, Barbara Roberts, requested that President Bush declare the Blue Mountains a national disaster because of the forest health situation.

Forest pests are an integral functioning component of the ecosystem. A bark beetle or a spruce budworm is as important a part of the ecosystem as an elk, deer, or a spotted owl. Budworm, bark beetles, and other insects are important diets of many wildlife species. Some wildlife species eat dwarf mistletoe shoots. Others build nests in the dwarf mistletoe brooms. We do not propose or even try to eliminate all forest pests, only to reduce their numbers to a level which would reduce the chances of a catastrophic outbreak.

Forest health should be measured by four values which are: 1) a functioning ecosystem 2) biodiversity 3) forest sustainability 4) production of goods and services. All four of these values are important. Timber harvesting should not destroy the first three values just to produce goods and services. Our goal in multiple use management is to maintain or even enhance the first three values while providing some goods and services.

Some stands within the Angostura analysis area are not healthy because of high levels of dwarf mistletoe and spruce budworm. Insect and disease aerial detection survey flights in 1990 identified spruce budworm infections on 310,000 acres in Arizona and New Mexico. The Carson National Forest had more acres defoliated by spruce budworm (131,000 acres) than any national forest in Arizona and New Mexico. The flights identified moderate to high levels of spruce budworm infestations within the Angostura analysis area. Stand exams and intensive reconnaissance have identified high, moderate, and low levels of spruce budworm and dwarf mistletoe infections. Spruce budworm are defoliating the white fir, Engelmann spruce, blue spruce, Douglas-fir, and corkbark fir trees. Dwarf mistletoe is infecting the Douglas fir trees. Later aerial detection flights (1992) indicate spruce budworm populations have since collapsed to undetectable levels making the immediate suppression of spruce budworm populations less urgent and the prevention of future epidemics the primary objective of future forest health emphasis within the analysis area.

Light selection cuts, where only high risk and mature trees were harvested from the stand, did little to control, and in some cases even increased dwarf mistletoe and spruce budworm infections. In stands that are severely infected with spruce budworm or dwarf mistletoe, or are considered to be high risk for infection, in the Angostura analysis area, the shelterwood silvicultural system will be used. Research and experience has shown that the shelterwood system is effective in controlling both dwarf mistletoe and spruce budworm.

Spruce budworm larvae feed primarily on buds and the current years foliage of trees. Sustained heavy attacks by budworm will cause complete defoliation, resulting in severe growth loss, top-kill, and mortality. Selection cuts leave multi-storied stands which create ideal habitat for spruce budworm. Budworm larvae disperse and move around a lot during feeding, and much of that dispersal is downward. In multi-storied stands budworm larvae will fall from one tree to the next, perpetuating the feeding activity, before finally falling to the ground. The shelterwood system creates an even-aged stand of trees which has only one or two stories. In even-aged stands budworm larvae will attack fewer trees before falling to the ground; where they will then be consumed by ants, birds, or other predators. Trees are generally faster

growing and more vigorous in an even-aged stand and can recover from budworm defoliation better.

The multi-storied stand structure also aids in the spread of the parasitic plant, dwarf mistletoe. The seeds in the dwarf mistletoe berries shoot out and usually travel from 10 to 20 feet. If these seeds fall on another tree, that tree may become infected. That tree may be weakened or outright killed by the dwarf mistletoe infection. In a multistoried stand where the tallest trees are infected with mistletoe, the chance of a seed falling on another tree is greatly increased, and thus the spread is much faster. In an even-aged stand many of the mistletoe seeds will just fall to the ground and not infect adjacent trees.

All stands within the Angostura analysis area were given a silvicultural priority for treatment based on the

severity of the insect and disease infections in the stand, the potential for budworm susceptibility, and the condition of the stand. This information was obtained from stand exams and field reconnaissance. In each alternative, high priority stands were given priority over other stands for treatment, when treating that stand did not conflict with achieving the other objectives of that alternative. The sustained yield and the health of the forest can be maintained or even increased by treating as many high priority stands as possible. Table 4 displays how each alternative compares in treating the high priority stands. Tree mortality, growth losses, and the chances of a catastrophic forest pest outbreak can all be reduced. However, all high priority stands can not always be treated since the treatment may interfere with achieving other resource objectives.

## Sustainability [V10/19/92] [Vegetation Diversity]

Sustainability refers to the ability to manage forest resources for goods and services over an infinite period while maintaining long term ecological values. In order to assess the sustainability of the proposed harvest alternatives over time, estimates of vegetation structure (age class mix) were calculated for each alternative assuming the same exact harvest treatment would be repeated within the analysis area every 20 years. Although repeating the same management scheme every 20 years may not be either desirable or practical, it provides a means to display what each alternative does over time in regards to vegetation diversity, and illustrate the dynamics of the forest growth. The following assumptions were developed and used in evaluating the sustainability of each alternative:

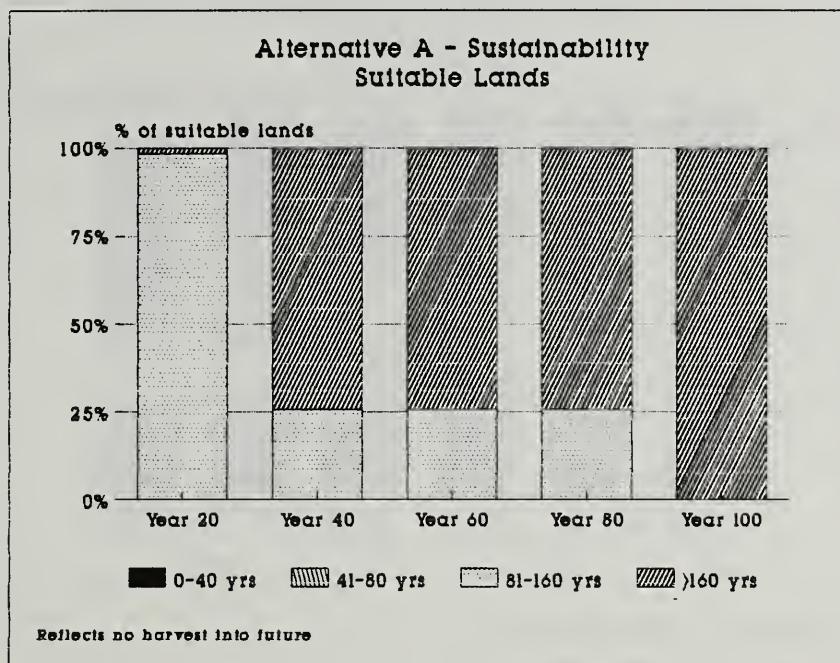
- The same harvest scheme is repeated every 20 years i.e., The same number of acres would be harvested by the same silvicultural prescriptions.
- Acres harvested by the Group Selection prescription:
  - 100% converted to early successional 0-40 year age class
- Acres harvested with Removal of 12 inches + DBH prescription:
  - 70% to mid-successional 41-80 year age class
  - 30% to early successional 0-40 year age class
- Acres harvested with Removal of 14 inches + DBH prescription:
  - 40% remain in mid-successional 80-160 year age class

- 40% converted to mid-successional 41-80 year age class
- 20% converted to early successional 0-40 year age class
  - Acres harvested with Seed Cut prescription:
    - 80% remain in mid-successional 80-160 year age class
    - 20% converted to early successional 0-40 year age class
  - Acres harvested with Commercial Thinning prescription:
    - 100% remain in mid-successional 80-160 year age class
  - Acres harvested with Patch Clearcut (Aspen):
    - 100% converted to early successional 0-40 year age class
  - Acres harvested with commercial thinning prescription:
    - 100% remain in mid-successional 80-160 year age class

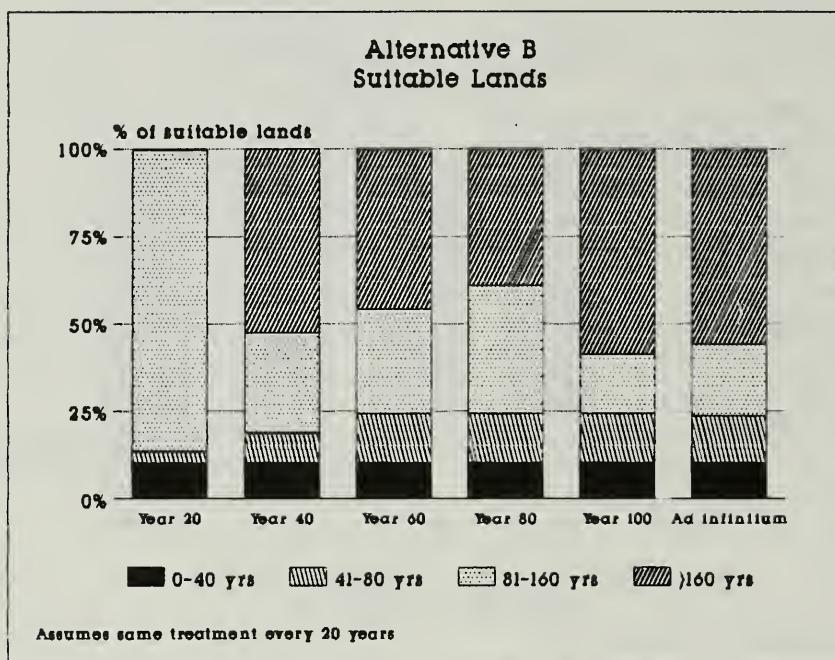
In each alternative, acres were calculated immediately after harvest and then "grown" for 20 years before applying the same harvest again.

Tables 12-18 display the age class mix immediately following each 20 year harvest up until a point at which age class mix becomes generally constant i.e., age class mix remains constant after each treatment and twenty years following treatment.

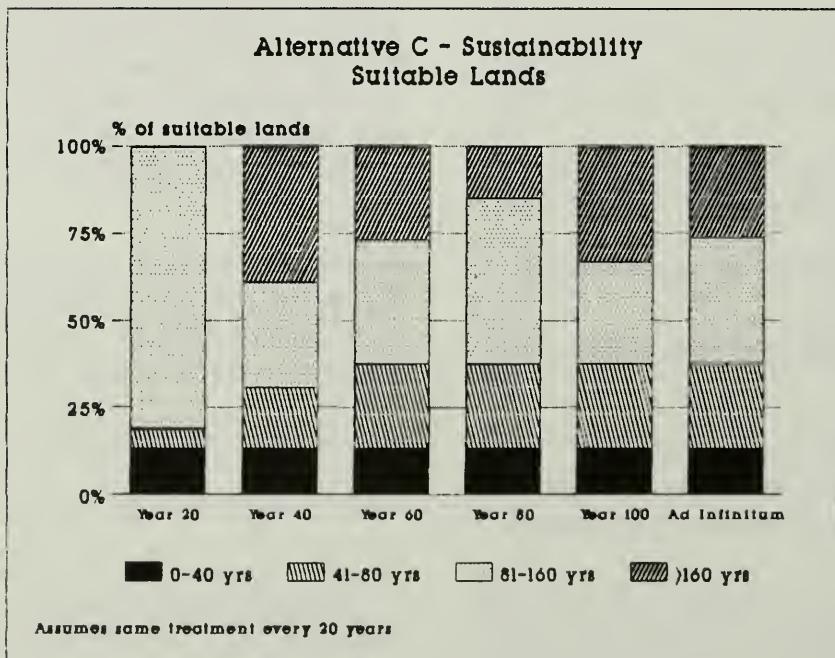
**Table 12. Alternative A Sustainability (No action, grown for 100 years)**



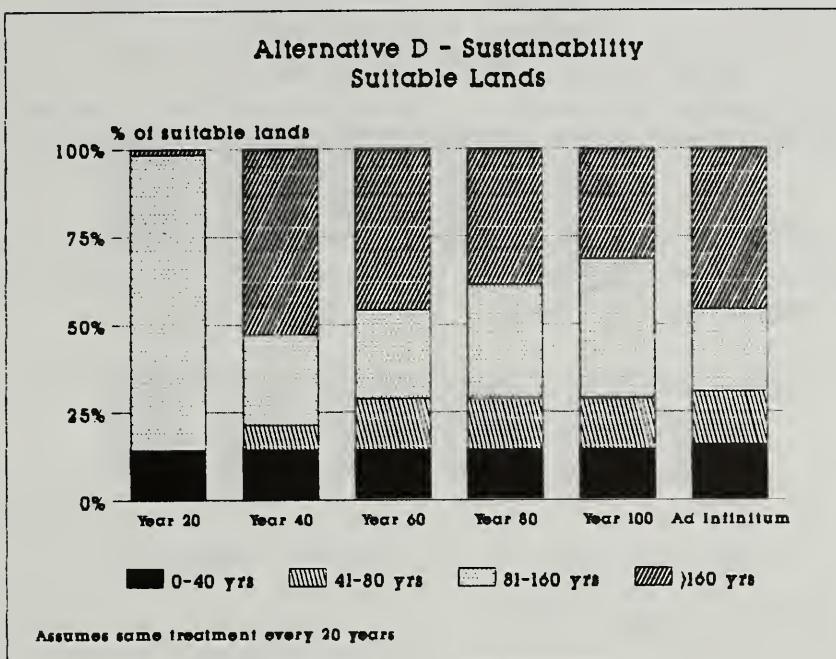
**Table 13. Alternative B Sustainability**



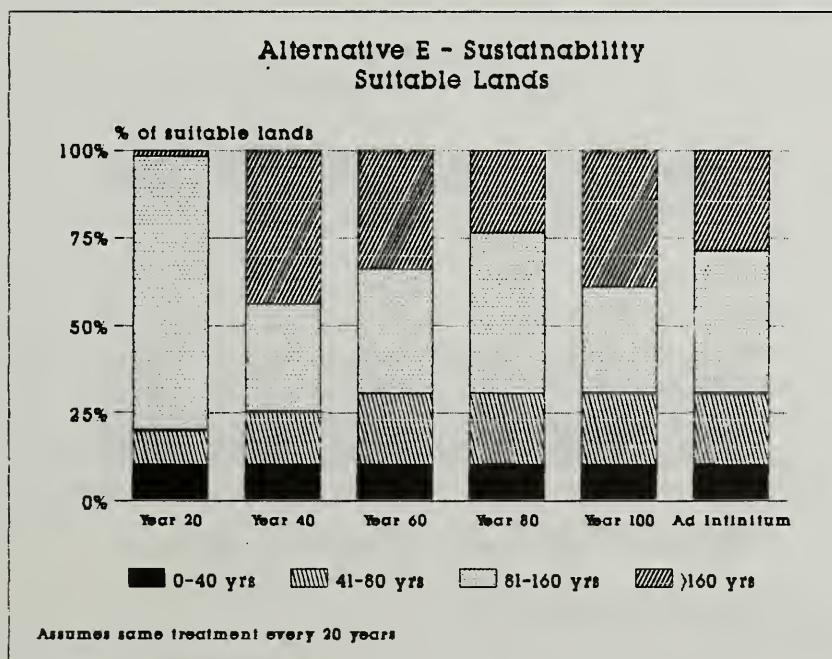
**Table 14. Alternative C Sustainability**



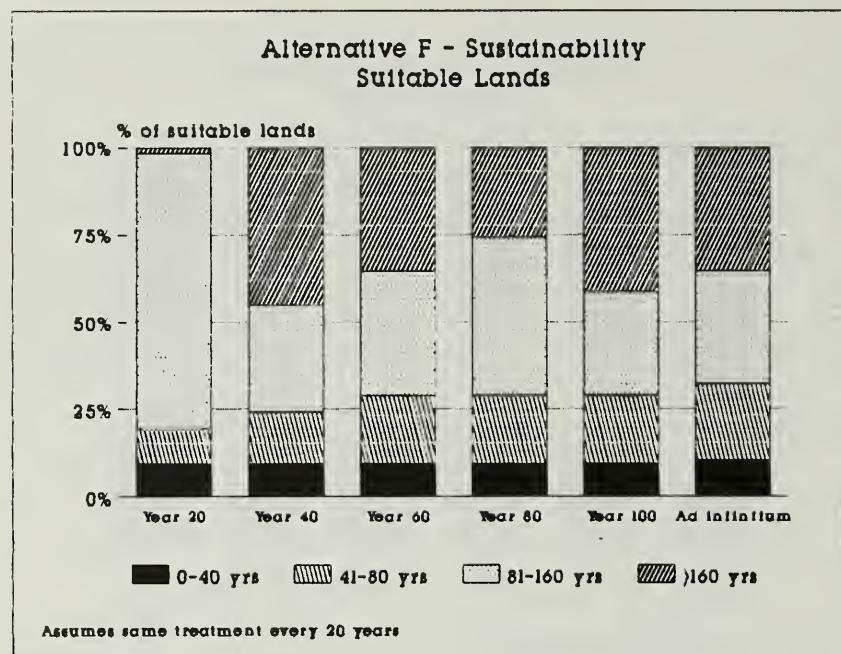
**Table 15. Alternative D Sustainability**



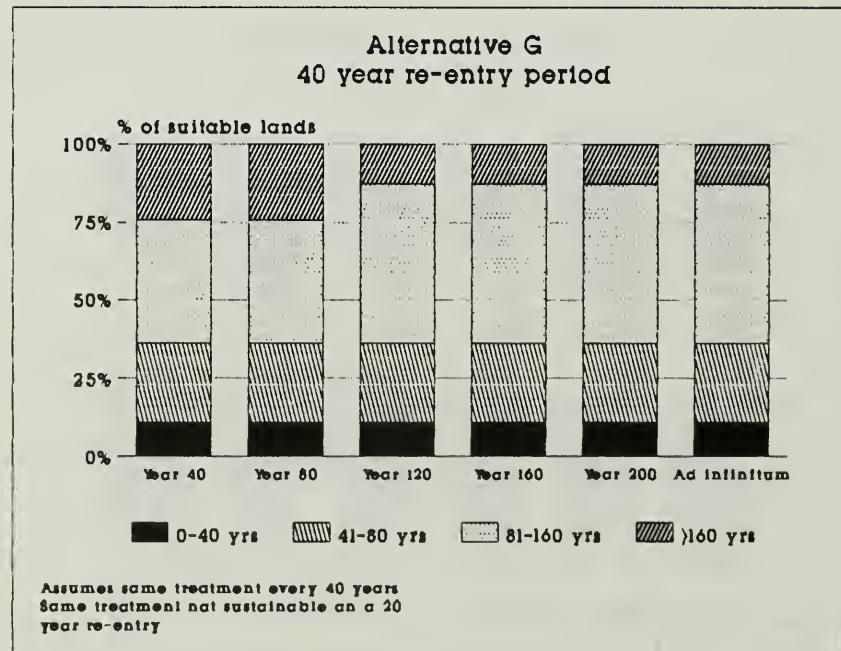
**Table 16. Alternative E Sustainability**



**Table 17. Alternative F Sustainability**



**Table 18. Alternative G Sustainability**



As illustrated in the above tables, all of the harvest alternatives, if repeated every 20 years, except alternative G, maintain an old growth component greater than 25% indefinitely on the suitable lands assuming no natural catastrophic events such as fire an/or insects. Lands classified as not suitable would not be harvested under any alternatives and thus would grow into an old growth component within 100 years.

Assuming a repeat of the same harvest treatments, Alternative G is not sustainable on a 20 year re-entry period. This does not necessarily mean it is not an

acceptable alternative, but instead means that future harvest treatments would need to be scaled down in regard to acres treated. Since the major cost is roads, which are built during the first entry, it could be considered economically favorable to harvest more volume in the first entry to pay for the roads and scale back future harvests when road cost would be minimal.

Assuming the exclusion of natural catastrophes, alternative A would result in the entire analysis area being in a late successional condition by year 100.

### **Old Growth (V8/18/92, W8/12/92, W8/13/92.1, W8/13/92.2)** [Vegetation Diversity, Old Growth]

Special emphasis is placed on old growth. The Carson Forest Plan says, "We focus on the forest -- a total ecological system -- a recycling system. A key to the sustainable forest is old growth. We will manage old growth to provide the following values: blueprint and sustainability; habitat diversity, recreation and aesthetics; opportunities for spiritual nourishment; high quality products." [LR1986.1, p.C.Sustainable Forest-1]

Old growth reflects a condition defined by the following factors: number, age, size, and density of trees; number, size, and height of snags (standing dead trees); the number, size, and length of downed logs; years since man-caused disturbance [LR1986.1, page C.Sustainable Forest-5].

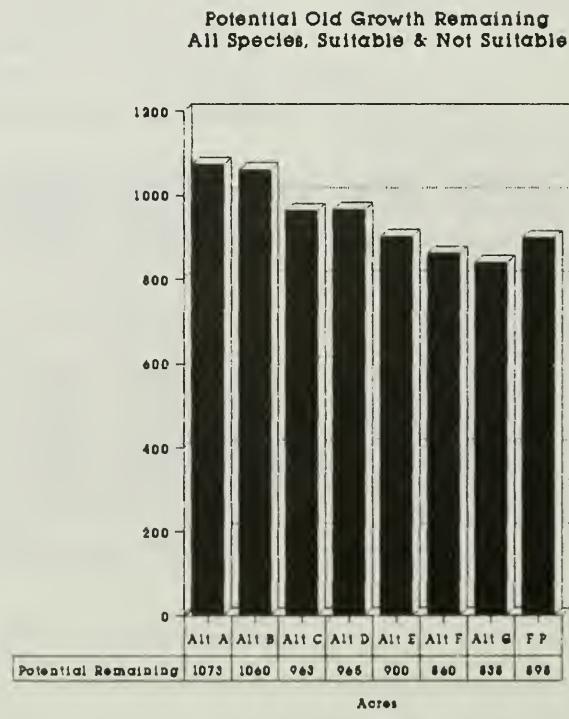
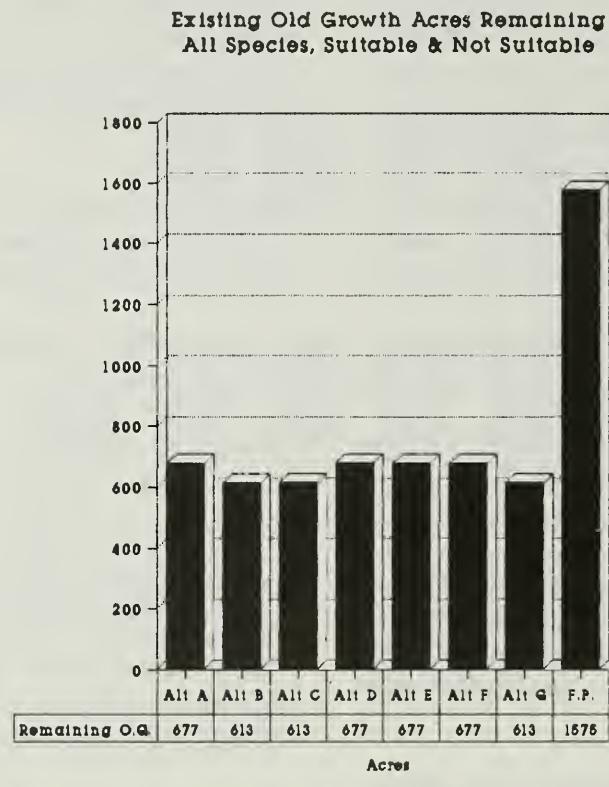
Old growth areas are necessary to maintain healthy, diverse, and productive ecosystems. Old growth provides important diversity for wildlife habitat. The dead standing trees in old growth stands provide cavity nesting sites for many kinds of birds. Decaying logs on the forest floor provide habitat for many plants and animals. Old growth provides migration corridors, protection from extreme weather, and specific food sources for many wildlife species. People enjoy the aesthetic and spiritual experiences unique to old growth forests. Old growth forests are important so that we and future generations can study what makes forests sustainable. Retaining old growth retains our options for the future.

The Carson Forest Plan states that a minimum of 6% of the suitable acres and 18% of the total forested acres within each diversity unit will be allocated to old growth. The 18% old growth figure was derived from wildlife habitat models. It was inferred from the models that a variety of stand age and canopy densities best provided for all the wildlife species of the forest and was consistent with other uses of the forest (LR1986.1,p. Sustainable Forest-7).

Tables 19 and 20 show the extent of acres which currently meet the Forest Plan existing and potential old growth criteria and how many of those acres would remain after proposed treatment. Alternatives B, C, and G will reduce the acres of existing old growth by 10 percent. Alternatives D, E, F, will not harvest any acres of existing old growth.

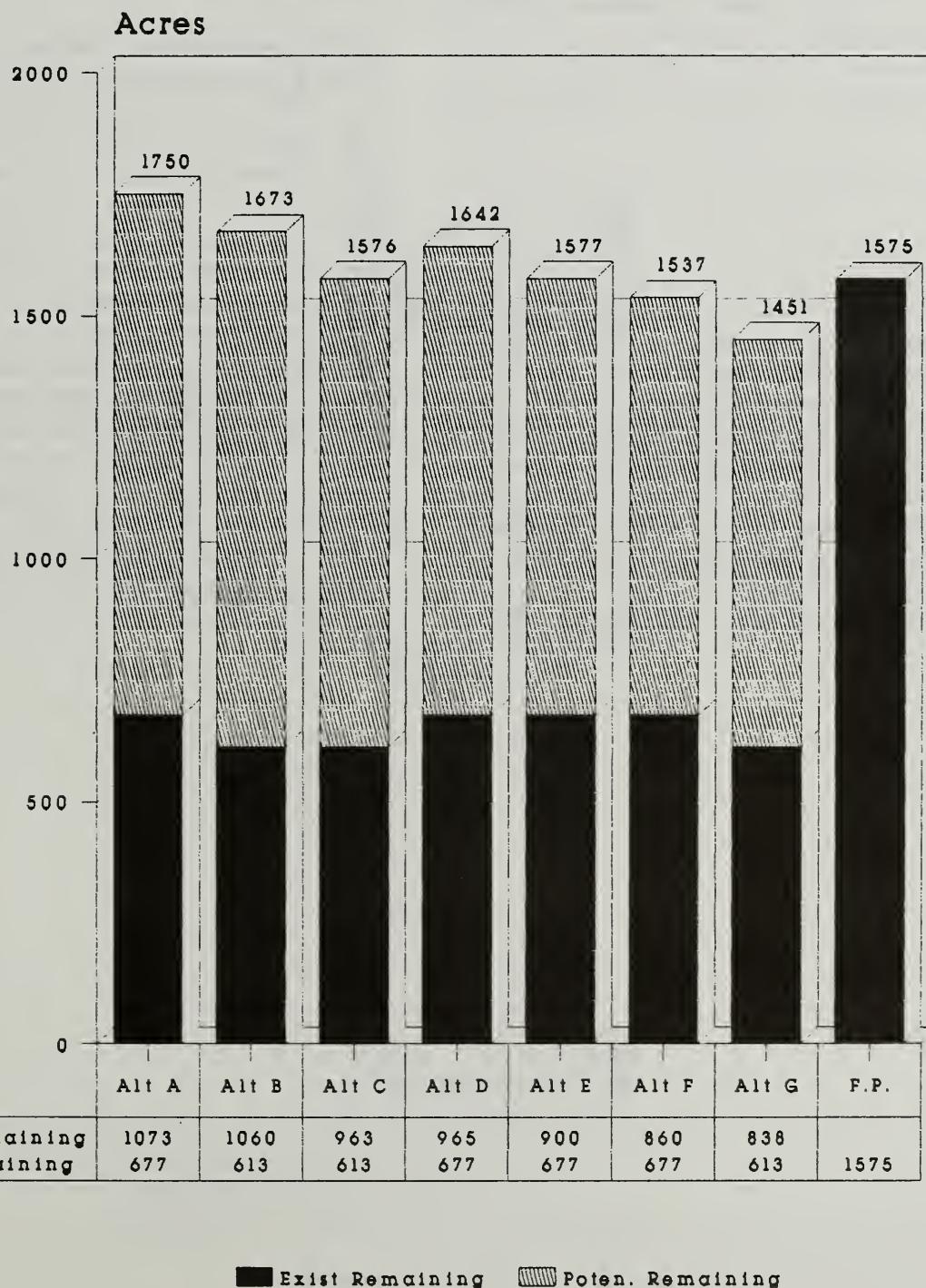
All action alternatives propose harvesting varying amounts of potential old growth acres, but as illustrated in Table 20, there are enough acres remaining within the existing and potential old growth categories to meet at least the minimum standard of 18% within the diversity unit with the exception of Alternatives F and G which reduce existing and potential acres slightly below 18%. Alternatives F and G would require allocation of acres within the 80 - 160 year age class which do not currently meet existing or potential old growth structural characteristics.

**Table 19. Existing and Potential Old Growth Acres Remaining (All Species)**



**Table 20. Existing and Potential Old Growth Acres Remaining (All Species)**

**Exist. & Pot. Old Growth Remaining  
All Species, Suitable & Not Suitable**



Alt A = Existing

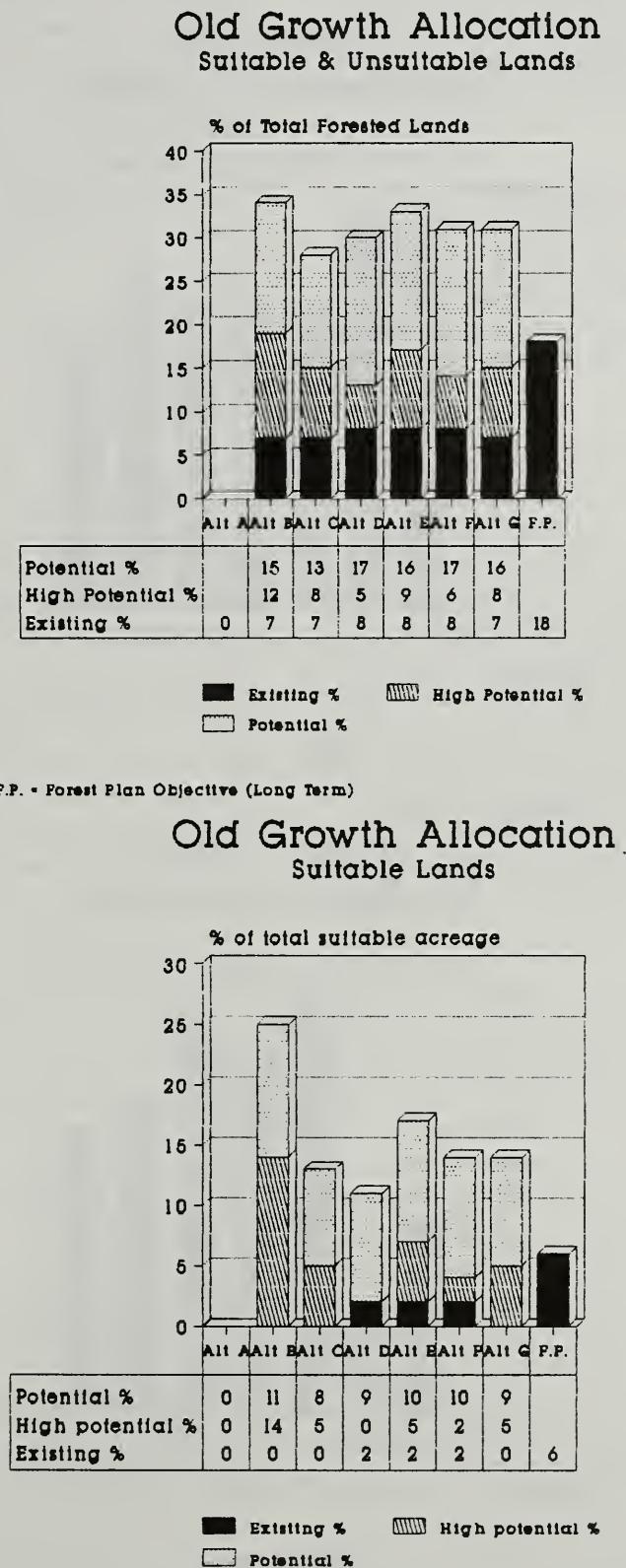
F.P. = Forest Plan Objective (Long Term)

Table 21 shows an overview of the old growth allocations proposed by each alternative in the Angostura Analysis Area on suitable and not suitable acres and on suitable acres only. Categories shown are existing, highly potential, and potential old growth. Potential old growth here refers to acres which do not meet the Forest Plan criteria of existing or potential but do meet the standard of undisturbed described in the Forest Plan [LR1986.1, page Sustainable Forest-5]. All action alternatives propose to allocate more acres than the minimums of 6% on suitable and 18% on total forested lands. On suitable lands the allocations range from a low of 11% in alternative D to 25% in alternative B. On total forested lands (suitable and unsuitable) the allocations range from a low of 28% in alternative C to a high of 34% in alternative B, all significantly higher than the Forest Plan minimum of 18%. The ID team felt that since a relatively large portion of the existing and potential old growth currently occurred within Management Area 20 (Semi-Primitive, Non-motorized), that more acres should be allocated to ensure favorable distribution throughout the diversity unit for the future. Allocations on suitable lands also significantly exceed minimum standards because the team felt that the unroaded, pristine character of the area warranted a higher percentage. Approximately 701 acres (40%) of the existing and highly potential old growth is located on suitable lands (mostly potential, only 4% is existing). Allocat-

tion of suitable acres in excess of the Forest Plan standard of 6% will reduce the amount of sawtimber and forest products available for harvesting, now and in the future. Alternative A (no action) does not allocate any acres to old growth as it represents the "status quo" alternative in which no actions, including harvesting, road construction, or old growth allocation would occur.

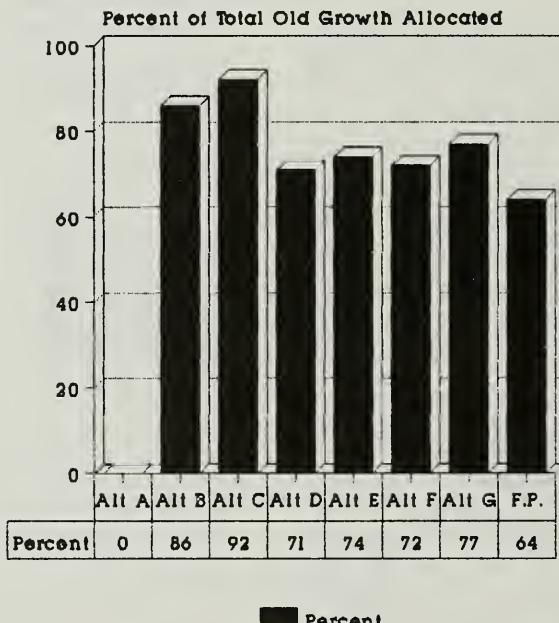
Table 22 represents a breakdown by vegetation type of old growth allocations for each alternative. Previously, Table 6 indicated that 5,639 acres (64%) of the total forested land within the analysis area is the spruce-fir forest type, and 1,773 acres (20%) is in the mixed conifer forest type. To ensure favorable distribution of old growth among vegetation types, allocations should approximate the percent each vegetation type represents within the analysis area. As Table 20 illustrates, all action alternatives allocate at least 64% of the old growth allocation within the spruce-fir type. All Action alternatives except alternatives B and C allocate at least 20% of the old growth allocation within the mixed conifer forest type. Alternatives B and C proportionately allocate more acres within the spruce-fir type. Since 64% of the total forested acres are within spruce-fir, opportunities are higher to locate acceptable old growth stands within the spruce-fir type.

**Table 21. Old Growth Allocation, Total Forested Lands & Suitable Lands Only**

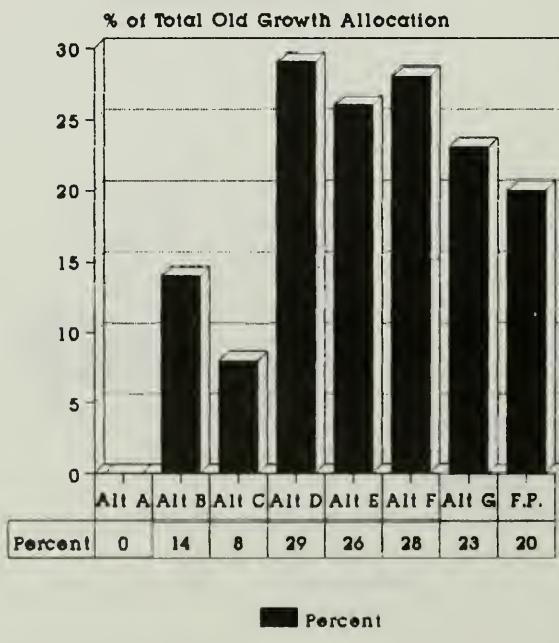


**Table 22. Old Growth Allocation, Spruce-fir & Mixed Conifer**

### Spruce-fir Old Growth Allocation



### Mixed Conifer Old Growth Allocation



The alternative maps (Maps 2-8 in Chapter 2. Alternatives) show the different approaches to size and distribution of old growth allocations. Table 4 lists the acres allocated to old growth in each alternative. Wherever possible, existing old growth and potential old growth were combined in allocations to ensure a relatively large block of old growth to minimize fragmentation of habitat. In order to achieve this goal, stands which did not meet existing old growth criteria were selected as potential old growth stands to provide the desired continuity. As mentioned earlier in Chapter 1 under Old Growth, present condition, there seems to be very little difference in those stands which meet Forest Plan existing and potential old growth criteria and those sawtimber sized stands which do not. This is attributable to the fact that the existing and highly potential old growth stands within the spruce-fir type are relatively "young" old growth stands and haven't developed high quality old growth attributes such as canopy gaps, and high numbers of dead standing trees or down logs. Most of the spruce-fir stands in the 80-160 year age class are very similar, with diameter size differences mainly attributable to residual tree densities remaining after harvesting at the turn of the century i.e., Although the trees are the same age, diameters may be larger if the stand had less competition between trees for available nutrients. The other difference noticed is that some of the stands had a sparse stocking of older, larger trees which were not harvested during the initial harvest. Because of the small differences between stands that met Forest Plan old growth criteria and the stands classified as potential old growth, more emphasis was placed on creating continuous blocks of old growth allocation as opposed to whether the stands met the exact criteria or not. With the exception of alternatives B, C, and G, all existing old growth is allocated in the harvest alternatives and all allocations meet the Forest Plan criteria of "undisturbed" and could be expected to develop into quality old growth during the next 40 years.

The Carson National Forest Old Growth Inventory was used to determine potential cumulative effects of harvesting old growth and potential old growth acres. Approximately 66,000 acres surrounding and including the analysis area were assessed within the Rio Pueblo Watershed [W12/92.1]. This represents approximately 78 percent of the entire 84,000 acre watershed and almost all of the acres within the mixed conifer and spruce-fir ecosystems within the watershed. Table 24 is a summary of the old growth inventory information for this portion of the watershed. In instances where there was more reliable data, such as within the Angostura analysis area, which the in-

ventory did not reflect, these acres were added to the inventory acres. For example, the inventory did not identify any existing or potential old growth within the Angostura analysis area. Through site specific stand examinations, the team identified 1,750 acres within the analysis area which met Forest Plan criteria for either existing or potential old growth. These acres were added to those acres identified in the old growth inventory.

The Forest Plan objective over the long term is to have approximately 18% of the forested area on the Forest in an old growth condition. This objective is monitored by diversity unit, assuming that if each diversity unit meets this objective, the Forest as a whole will meet it [LR1986.1, page Sustainable Forest-7].

Table 24 illustrates that within the Rio Pueblo Watershed approximately 7 percent of the acres within the total land area within the watershed meet existing old growth criteria, 4 percent meet highly potential old growth criteria, and 8 percent meet potential old growth criteria. This represents approximately 19 percent as either existing, highly potential, or potential old growth. This is a conservative estimate as non-forested acres were not calculated because site specific data was not available to determine percent of non-forested acreage within the watershed. It also does not account for the forest dynamics which ensure that within the next 20-40 years many acres not included in the inventory will grow into old growth conditions.

Table 23 displays results of the Forestwide old growth inventory started in 1991. The Forestwide old growth inventory identified 19,424 acres which meet the Forest Plan old growth definition out of 113,000 acres inventoried. Another 57,327 acres meet the Forest Plan definition of potential old growth. Consequently the inventory indicates that presently there is approximately 17% existing old growth on the Forest with another 50% of the inventoried acres identified as meeting Forest Plan criteria for potential old growth [W12/22/92]. Although the old growth inventory is not 100% complete and data continues to be collected and updated, it is considered to be a good, conservative sample Forestwide of the current and future availability of old growth habitat on the Forest. Conservative interpretation of this inventory data indicate that current existing old growth on the Forest meets Forest Plan objectives and that an adequate supply of potential old growth acres exists to sustain and/or increase old growth objectives in the future.

**Table 23. Forest Old Growth Inventory Summary**

Categories	Acres/Percent of acres inventoried
Acres inventoried	113,000
Old Growth	19,424 (17%)
Highly Potential Old Growth	18,849 (17%)
Potential Old Growth	38,478 (34%)
Total Old Growth and Potential Old Growth	76,751 (68%)

Alternatives B, C, and G propose harvesting 64 acres of existing old growth on suitable lands. Alternatives D, E, and F do not propose harvesting any existing old growth stands. All of the action alternatives propose harvesting varying amounts of potential old growth. Alternative B proposes harvest of 13 acres, Alternative C 110 acres, Alternative D 108 acres, Alternative E 173 acres, Alternative F 213 acres, and Alternative G 235 acres. Considering the 66,000 acres assessed within the watershed and the 113,000 acres assessed from the Forestwide inventory, none of the action alternatives reduce the amount of old growth and potential old growth shown in Tables 23 and 24 to below 18 percent.

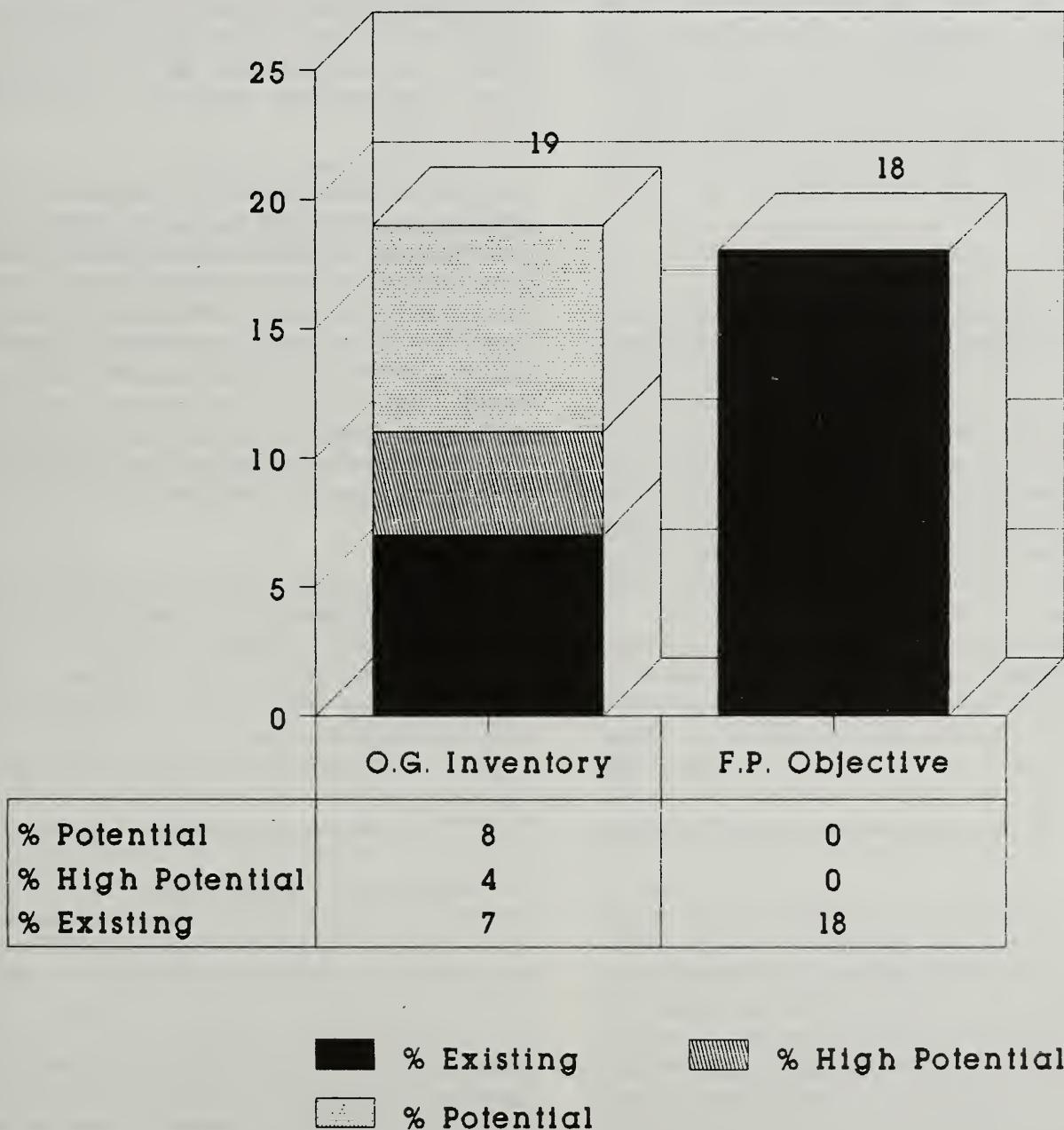
On a site specific basis, there is a shortage of existing old growth within the watershed currently, but with inclusion of the potential old growth category which will grow into existing old growth within the next 40 years, there are adequate acres to meet the 18 per-

cent Forest Plan standard and maintain at least that much indefinitely, excluding natural catastrophes such as fire and/or insects. Only three reasonably foreseeable future projects which have potential to affect vegetation structure are planned within the watershed; La Cueva Timber Sale, Alamitos II timber sale, and the Sipapu Ski Area expansion. Past projects have already occurred before the inventory and thus are included in the inventory figures. A liberal estimate of the total acres which will be harvested by these projects is approximately 3,500 acres which is 4 percent of the entire watershed. Considering that both proposed timber sales will result in allocation of a minimum of 18 percent existing or potential old growth as required by the Forest Plan and that this analysis is proposing allocating a minimum of 28 percent old growth it is highly unlikely that any of these actions separately or together will result in a significant negative effect upon retention of adequate old growth habitat.

Table 24. Existing and Potential Old Growth Within the Rio Pueblo Watershed

## Old Growth Rio Pueblo Watershed

### Percent of Forested Acres



F.P. = Forest Plan Objective (Long Term)  
 Includes 66,000 acres within watershed  
 O.G. = Old Growth

## **SOIL AND WATER (SW4/9/92, SW11/19/92)**

The Angostura Analysis Area lies within the Rio Pueblo watershed which is a major tributary to Embudo Creek, a tributary of the Rio Grande in northern New Mexico. The analysis area encompasses approximately 10,100 acres which are drained primarily by Rito Angostura and Agua Piedra Creek with some smaller drainages (i.e., Knob Creek). Approximately 4,900 acres of the analysis area is drained by the 6,400 acre Angostura watershed, 3,500 acres of the analysis area is drained by the 4,150 acre Agua Piedra watershed and the remaining 1,650 acres are drained by "face" drainages such as Knob Creek flowing directly into the Rio Pueblo. Both Rito Angostura and Agua Piedra Creek are perennial streams which support resident populations of fish.

### **Water Yield**

During the period of 1936-41 the USGS operated a continuous discharge station on the Rio Pueblo just below the Forest Service boundary. This station recorded an annual average water yield from the Rio Pueblo of 30,977 acre feet with approximately 60% of the flow occurring during the months of April and May. This is indicative of a typical snowmelt dominated hydrologic regime with very high flows during the spring and much lower flows throughout the remainder of the year. Recently, the USGS installed a new gage on the Rio Pueblo in a location very close to the old gage. Data from this new gage has not yet been analyzed but with one years data collected, the annual yield appears to be in the range of 32,000 acre feet per year with the same general timing recorded by the earlier gage. The Carson National Forest Analysis of the Management Situation estimated the average yearly flow from the Rio Pueblo to be 24,000 acre feet per year.

There are no long term streamflow or water quality records for either Rito Angostura or Agua Piedra Creek, however the Forest Service collected limited data on these two streams during the summer of 1992. Flows in Rito Angostura were too low to measure with conventional stream gaging equipment and were estimated to be less than 1 cubic foot per second (cfs) during site visits in July and August 1992. No flow measurements were taken for Agua Piedra

Creek, however, on November 3, 1992 the flow was estimated to be 2 cfs. The flows of Rito Angostura are impacted by the La Sierra Ditch which diverts the majority of the flow generated by the upper Rito Angostura watershed out of the basin and over to the Alamitos drainage. Based on previous water resources studies in the region, it could be expected that given the elevational and vegetative characteristics of the project area, the annual water yield per unit area would be approximately 5.0 to 6.0 inches. This would result in a total water yield from the analysis area of approximately 4,600 acre feet per year [SW11/19/92].

The potential effects of road building and silvicultural activities on water yield and water quality are well documented in the literature and in previous analysis of activities on the Carson National Forest (Troendle 1987, Hibbert 1979, Troendle 1983, Ffolliott et al 1989). The Carson Forest Plan analysis indicated that only very minor water yield increases could be expected even under the most intensive management scenario considered for water yield increases. The silvicultural activities proposed for the Angostura analysis area are not designed to increase water yields.

Various studies have shown that a significant portion of a watershed needs to be harvested in order to realize a change in streamflow. Uniform thinning of forest and brush stands in the southwest must remove about 50% of the crown cover before water yield appreciably increases (Troendle 1988). A study of Aspen clearcuts showed that removing 13% of a 217 acre watershed had no significant effect on streamflow (Johnson 1984) and when 45% of the basal area was removed by single tree selection harvest in a 318 acre watershed in Arizona, streamflow responded only in very wet years. Various studies have estimated that 20-30% of a watershed must be harvested before a detectable change in streamflow can be realized. The most intensive harvest alternative of those being considered for the Angostura analysis proposes to harvest 16% of the analysis area acreage. Table 25 presents descriptive characteristics used in interpreting potential effects on water yield.

**Table 25. Harvest and Road Characteristics Used To Estimate Soil/Water Effects For The Analysis Area**

Harvest Type	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Group Selection (acres)	0	145	110	315	87	63	87
Removal (acres)	0	170	405	0	374	518	1091
Seed Cut (acres)	0	64	172	0	0	45	115
Thin From Below (acres)	0	200	200	200	200	200	200
Intermediate Thinning	0	0	0	169	0	0	42
Patch Clearcut(Aspen)	0	44	58	12	0	30	85
Roads (acres cleared)	3	27	26	24	15	23	37
Total (acres)	3	650	971	720	676	879	1657
% of Angostura Sub-Watershed	0	6.4%	9.6%	7.1%	6.7%	8.7%	16.4%

Given the low percentage of area being harvested and that the basal areas of the stands following proposed harvest will remain generally high, and that only a very minor portion of the overall analysis area basal area will be affected, it is not anticipated that any of the alternatives will create a detectable alteration in streamflow timing, peakflow, or annual water yield. There will undoubtedly be some site specific increases in soil moisture due to increased catch of snow in the small openings created if harvest occurs, however this amount of increased snow water equivalent will be undetectable as it affects streamflow.

### Water Quality

Current water quality in the Rito Angostura and Agua Piedra Creek is generally good. This assessment is based on data from the Carson National Forest Terrestrial Ecosystem Survey (TES), General Aquatic Wildlife System (GAWS) surveys, Riparian area survey transects (RASES), limited water quality sampling in the Rito Angostura, and cutthroat trout surveys conducted within the analysis area.

The entire Angostura analysis area is in satisfactory watershed condition based upon existing cover and current soil loss tolerance figures from the Carson National Forest Terrestrial Ecosystem Survey [SW12/13/89].

General Aquatic Wildlife System (GAWS) surveys were performed on the Rito Angostura during the summer of 1988. Results of these surveys indicated that the condition of the fisheries habitat on this creek is very high indicating water quality is high [W8/14/90].

There have been three riparian area survey transects (RASES) conducted in the analysis area along Rito Angostura. Results of these surveys indicate that the

creek is a typical high gradient confined mountain stream with a gravel/cobble substrate. These transects indicate some inorganic sediment deposition in the channel just below the diversion for the La Sierra ditch. It is surmised that the disturbance created by the diversion has contributed significantly to the embededness of the stream substrate directly below the diversion [SW11/19/92].

Scattered water quality samples were taken in the summer of 1992. Grab samples were collected on Rito Angostura four times at four locations along the creek from the confluence with the Rio Pueblo. Results are indicative of generally good water quality [SW11/19/92].

During July of 1990, Rio Grande Cutthroat trout surveys were conducted in the Rito Angostura. Survey results indicate the Rito Angostura as a very high quality aquatic habitat indicative of high water quality [W8/14/90].

The major impact on water quality from the proposed timber harvesting and related activities is the delivery of sediments into the channel network, over and above the natural erosional processes. The potential for adverse impacts to water quality is greatest from construction of the road system to facilitate removal of harvested timber. These impacts are related to the amount of roads proposed and the proximity of these roads to the stream channel system along with the number of active channel crossings. New road construction is particularly important since there is usually a considerable amount of cut and fill slopes which are generally unvegetated and in many cases not compacted. Erosion rates from roads are usually highest during the first two years after construction and decline to a relatively stable level within five years. To a lesser extent, sedimentation into the channel may be attributable to a lack of effective

ground cover after harvest within treatment units and the proximity of harvest units to the channel system.

In order to determine effects from reduction of effective ground cover and proximity of harvest units, data from the Carson National Forest Terrestrial Ecosystem Survey (TES) were input into the Universal Soil Loss Equation (USLE) computer program. Tolerance levels are assigned to each TES mapping unit. Tolerable soil loss is the point at which the rate of erosion is greater than the rate of natural soil development. This tolerance level is described in tons per hectare and was developed from field examination and actual soil samples taken during the Terrestrial Ecosystem

Survey. Soil tolerance levels are exceeded when the rate of erosion surpasses the rate of natural soil development. In order to display erosional effects from harvest activities, an extreme case scenario was developed which assumed that 100% of the overstory would be removed followed by post treatment burning. Although none of the proposed silvicultural treatments are of this intensity, it represents an extreme case scenario for soil movement and loss and provides a basis for comparing alternatives. Table 26 displays the number of acres which would result in unsatisfactory watershed condition (soil movement exceeds tolerance levels) immediately following harvest under an extreme case scenario.

**Table 26. Temporary Unsatisfactory Watershed Condition Following Harvest Under An Extreme Case Scenario**

ALTERNATIVE	ACRES UNSATISFACTORY	% OF WATERSHED
Alternative A	0 acres	0%
Alternative B	34 acres	0.3%
Alternative C	124 acres	1%
Alternative D	0 acres	0%
Alternative E	140 acres	1%
Alternative F	60 acres	0.6%
Alternative G	391 acres	4%

The above table displays an extreme case scenario for the purposes of comparing alternatives. Even under an extreme case scenario the amount of area resulting temporarily in unsatisfactory condition is not significant. Under the extreme case scenario, all acres which exceed tolerance levels would recover to acceptable soil loss tolerance levels one year following harvest in all action alternatives. In reality, with the implementation of standard mitigation measures listed at the end of Chapter 2, none of the action alternatives would result in any TES unit exceeding soil loss tolerance levels. Alternative D represents the least potential for excessive soil loss of all the action alternatives primarily because fewer acres are harvested by the overstory removal prescription and less acres are harvested on soils more susceptible to erosion. Alternative G represents the most potential for ex-

ceeding soil loss tolerance levels because a larger percentage of the silvicultural prescriptions are overstory removals and more acres are being harvested resulting in more acres being harvested on TES units which are more susceptible to erosion.

As indicated earlier, the potential for adverse impacts to water quality is greatest from the proposed road system. In the case of the proposed Angostura timber sale project, there are essentially two roading options. The lower route continues up existing Forest road 89 from the Angostura summer home development and the upper route extends a road network from Forest road 161 from its current terminus. Table 27 presents descriptive characteristics that were used in interpreting the erosion environmental effects from proposed road systems.

**Table 27. Alternative Characteristics Used To Estimate Soil/Water Effects**

Disposition of Roads	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Existing Roads (miles)	1.5	1.5	1.5	1.5	1.5	1.5	1.5
New Roads (miles)	0.0	12.5	12.0	11.0	6.5	10.5	17.5
Reconstructed Roads (Miles)	0.0	0.0	1.5	0.0	1.5	1.5	0.0
Drainage Crossings (#)	0	9	8	9	5	8	9
After Treatment							
...Roads Closed (miles)	0	12.5	13.5	11.0	6.5	10.5	17.5
...Roads Open (miles)	1.5	1.5	0	1.5	0	0	1.5
...Access Point		FR161	FR89	FR161	FR89	FR89	FR161

Alternative A (no action) would leave the unit unroaded except for the low standard road which enters the unit from existing Forest road 89. This road would continue to contribute to some stream sedimentation of Rito Angostura in the vicinity of the low water crossing and along the portions where the road is in close proximity to Rito Angostura. Water quality in the unit would be expected to remain the same as it currently is.

The main concerns with all of the action alternatives is the number of live stream crossings by the proposed roads and the approaches to these crossings. As can be seen from Table 27 there are very little differences in the number of crossings except for alternative E. Each of the crossings will result in short term (2-3 year) impacts on the stream system. Short term impacts will be increased turbidity and suspended sediment. The long term impacts will be an increase in substrate embeddedness approximately 100 yards downstream of each crossing. In general, the fewer the number of live stream crossings, the less the impact.

Given the relative similarity in the amount of roading for each alternative (except alternatives E and G), the main differences in the impacts expected are related to the access point. All of the Forest Road 89 access alternatives (C, E, F) will have some portion of the road system paralleling the Rito Angostura for a distance of approximately 1.5 miles. There are portions of this alignment which will be in close proximity to the stream channel and on very steep slopes. It is likely that there will be some sediment delivered to the channel due to lack of an adequate buffer strip. The Forest Road 161 access alternative however, generally involves more live stream crossings and major crossings of the Rito Angostura. As stated above, these crossings will result in some short and long

term impacts to the stream system (increased turbidity and suspended sediment in the short term and some increase in substrate embeddedness over the long term).

In summary, the impact to water quality from each of the action alternatives will be very similar over both the short and long term. The differences lie mainly in the locality of the impacts. The Forest Road 89 option will result in localized impacts to the lower portion of the Rito Angostura while the Forest Road 161 option will result in localized impacts to the upper portions of the Rito Angostura. Based on the miles of road construction, the alternatives listed from least to most short term impact on water quality are A, E, D, F, B, C, and G respectively. In the long term, the relative impact from least to most are expected to be A, E, F, D, C, B, and G. With the implementation of standard mitigation measures and best management practices listed at the end of Chapter 2, the impacts to water quality from the implementation of any of the action alternatives would be localized both in the short and long term and would unlikely result in any violation of water quality standards.

### Cumulative Effects

Even though the Forest Plan Environmental Impact Statement analysis [LR1986.2] studied cumulative impacts, this analysis looked at the specifics of this proposed project.

In analyzing water quality, the following past, present, and future actions were

- Alamitos Timber Sale (Closed 1992)
- Dropout Timber Sale (Closed 1992)
- Picacho Timber Sale (Closed 1992)
- Duran Timber Sale (Closed 1990)

- Proposed La Cueva Timber Sale (1994)
- Proposed Alamitos II Timber Sale (1996)
- Proposed Sipapu Ski Area Expansion (1993)

In order to assess the cumulative effects of this proposal, past timber harvest activities, forest road construction activities, and State Highway 518 on the upper portion of the Rio Pueblo watershed (that portion above the Sipapu Ski Area and Flechado Canyon) were analyzed. This upper watershed contains approximately 47,900 acres or roughly half of the entire Rio Pueblo watershed. The procedure used was a variation of the "Sequoia Method" where management activities are evaluated against the Equivalent Roaded Acres (ERA). The ERA is a standard by which a wide range of impacts can be measured against to account for varying levels of disturbance. The process describes on-site impacts in terms of the equivalent number of acres of road that would produce an equal amount of impact. This ERA number is then compared to a "threshold of concern" at which a watershed needs to be closely inspected to determine if it is at a critical state. Defining an "absolute" threshold in terms of allowable level of management activity is improbable.

Coefficients have been developed which relate to relative disturbance. These coefficients have been assigned to harvest and site preparation activities as well as roads. The major foci are on the level of soil compaction and percentage of bare soil present in a watershed that results from management activities. Other factors considered are reduced evapotranspiration, reduced interception of precipitation, interception of subsurface flows, creation of hydrophobic soils, etc.

A recovery curve of 10 years was developed for the various management activities which have occurred in the upper Rio Pueblo watershed in recent years. These activities include harvest and roading activities in the Alamitos, Dropout, Picacho and Duran project areas, the established Forest Road network, and NM 518 (all existing roads in the upper watershed were considered regardless of age since the model assumes that roads never recover unless they are obliterated).

Previous studies using this particular methodology have resulted in estimates of the percentage of a watershed which can be in a "equivalent roaded condition" ranging from 2% (for extremely sensitive and previously degraded conditions) to 16% (for highly stable conditions). Applying these figures to the upper Rio Pueblo watershed results in a range of 958 to 7,665 acres which would be "available" to be in ERA at any one time before the threshold of concern is

reached. Based on the information available it is unlikely that the upper Rio Pueblo is either extremely sensitive (as related to watershed conditions) nor is it likely to be considered highly stable. Therefore, it is reasonable to assume that the ERA's available for the upper Rio Pueblo should lie somewhere between these two figures.

Results of the model run using the previous harvest activities and roads referred to earlier, along with the proposed activities which would result from Alternative G (the most intensive activity proposed in the Angostura project) showed that approximately 1145 acres of the upper Rio Pueblo watershed would be in an "equivalently roaded condition". This figure represents approximately 2.4% of the watershed which is at the extreme low end of what could be expected. Selection of any of the other alternatives proposed in the Angostura project would result in a smaller percentage of the watershed in ERA. At this level of impact, it is unlikely that there would be any detectable cumulative effect on the water resources of the upper Rio Pueblo watershed due to implementation of the Angostura project. The recent water quality sampling on the Rio Pueblo above the Sipapu Ski Area supports the conclusion that the upper Rio Pueblo watershed has not reached the "threshold of concern" as related to possible cumulative watershed impacts.

Effects of the proposed project and past activities within the upper Rio Pueblo watershed were analyzed using the WATSED model originally developed in Region 1.

### Results of Model Runs

Due to project time constraints, only two model runs have been performed to date. The first run analyzed the effects of Alternative E. This alternative was chosen since it reflects a relatively low level of harvesting and utilizes the reconstruction of FR89 for access into the unit. Another run was conducted on Alternative G, since this reflects the highest degree of timber harvest and utilizes the continuation of FR161 for access. It is assumed that since all other action alternatives are either very similar or lie between these two extremes, that impacts will be near or between those reflected in the two model runs.

The model first produces a Natural Watershed Condition (average annual) which is the same for all runs. This would be considered the background conditions.

This report consists, in part, of a total water yield for the watershed (in acre-feet/year), an estimate of the average annual peak flow (in cubic feet/second), the

flow rate (in cfs) which is 75% of the peak water yield which is felt to be when the stream has the most energy available to transport sediment, and the number of days when the water yield exceeds the 75% flow rate.

For the upper portion of the Rio Pueblo analyzed in these runs, the model predicts an annual average water yield of 37,896 acre feet, with a peak flow of 198 cubic feet per second, with 34 days per year having a flow rate of 75% of the peak or higher. The water yield and peak flow derivations produced by the model compare favorably with the November 1992 estimates and with the limited actual figures available. This would indicate that the model is calibrated to estimate watershed functions to some degree of accuracy.

Cumulative impacts of past and this proposed activity were input into the activities data file. These include the harvest and roading activities associated with the Alamitos, Dropout, Pichacho and Duran timber sales along with NM 518. At the time of this writing, the proposed La Cueva and Alamitos II projects have not progressed through the alternative stage to the point where they could be incorporated into the analysis. The Sipapu Ski Area Expansion proposal lies downstream of the analysis area and thus was also not included. Also, due to lack of information related to disturbance activities on private lands within the upper Rio Pueblo, these were not included in the analysis, but it is expected that the limited amount of private land in the area would have little effect on the model runs.

The significant portions of the model output related to cumulative effects due to past and proposed management activities include the following.

- Percent of water yield increase over the average annual water yield for the watershed (acre-feet)
- Percent increase in the water yield during the watershed's peak flow month (an indicator of increased instantaneous peak flow)
- Number of days when the water yield will exceed 75% of the watershed's peak flow (an estimate of changes to channel impact period from increased water yield)
- Annual percentage of potential sediment increase over the amount of sediment routed under natural conditions

- An estimate of the percent increase in sediment that might be accumulating in the stream system.

Results of the model runs predict a one percent increase in total annual water yield for both alternatives with a zero percent change in the mean annual instantaneous peak flow. As is documented in previous reports prepared by the Carson National Forest and others, this level of change is virtually impossible to detect given the natural variation inherent in watershed responses to natural events.

The model does predict a change in the duration of the 75% and greater flow period for Alternative G only. The predicted duration for this alternative increases by one day (up to 35 from 34). This is also not expected to result in any measurable changes in channel morphology due to increased stream energy. This affect will continue for at least 10 years (the models' prediction period).

Under alternative E, the model predicts a potential increase of 120 percent of sediment delivered to the stream channel for the first two years after treatment with a reduction to 60 percent after two years for the models' prediction horizon. Of this increase, the model estimates that none of the sediment will accumulate in the stream channel at any time.

For alternative G, the prediction is for a 240 percent increase in potential sediment delivery to the stream channel for the first two years after treatment followed by a 120 percent increase for years 3-4, and a 60 percent increase for future years. Of this sediment delivered the model estimates a potential 2% accumulation of sediment for years 1-3, followed by a reduction to 1% in year 4 with no accumulation beyond that time.

As stated in the November 1992 report, roads and stream crossings are the greatest contributor of sediment to stream channels due to management activities. I believe that the results of the model runs support that conclusion given the large differences in the road miles and stream crossings between the two alternatives. It is also very probable that accumulations of sediment (especially as predicted under Alternative G) would be most apparent in the vicinity just downstream of the individual stream crossings, as surmised in the previous report.

It would appear from this analysis that the potential long term impacts from this proposal would have minimal impact on the upper Rio Pueblo watershed with the degree of effect by alternative following A,E,F,D,C,B, and G from least to greatest.

## WILDLIFE

Even though the Forest Plan Environmental Impact Statement analysis (2) studied cumulative impacts, this analysis looked at the specifics of this proposed project.

Table 28 shows the past, present and future sales in the upper Rio Pueblo watershed, 29,300 acres over the past ten years.

To analyze potential cumulative effects on wildlife habitat, the Alamitos, Pichaco, Duran, Dropout, La Cueva, and Alamitos 2 sales have been considered together with the proposed Angostura timber sale (29,300 acres).

**Table 28. TIMBER SALES IN UPPER RIO PUEBLO WATERSHED 1986 - 1996**

Name	Year	Acres of Cut Unit	Mbf Cut	Miles of Road Construction	Miles of Road Reconstruction
Angostura	1994	900 <sup>1</sup>	3850 <sup>1</sup>	11.7 <sup>1</sup>	1.5 <sup>1</sup>
Alamitos	1988	525	5320	10.0	0
Dropout	1987	275	2100	4.0	0
Picacho	1986	576	4950	1.5	0
Duran	1986	712	4200	8.1	0
Proposed La Cueva	1994	unknown <sup>2</sup>	9500 <sup>3</sup>	unknown <sup>2</sup>	unknown <sup>2</sup>
Proposed Alamitos2	1996	unknown <sup>2</sup>	4000 <sup>3</sup>	unknown <sup>2</sup>	unknown <sup>2</sup>

<sup>1</sup> Average of All Harvest Alternatives

<sup>2</sup> Unknown because the sale has not been designed nor analyzed yet.

<sup>3</sup> Only an estimate planning volume set up when Forest Plan was developed five years ago. Actual volume would only be set after analysis of the area.

The upper Rio Pueblo watershed is a relatively distinct unit, geographically and ecologically. It is characterized by a mostly dense conifer and aspen forest, predominantly spruce-fir and high elevation mixed conifer. The upper Rio Pueblo watershed (approximately 29,300 acres) is large enough an area to assess the potential cumulative effects of the proposed sales on TES species, old growth, snag and closed canopy forest dependent birds, indicator species, and big game animals. The upper Rio Pueblo watershed also provides an area large enough to serve as a normal summer habitat for even the most wide ranging of these species, (i.e., big game and goshawk).

The Forest Plan EIS (2) looked at the cumulative effects of the 10-year timber sale schedule over the entire forest. This Angostura wildlife analysis is a site specific project analysis to identify and disclose the habitat and disturbance effects of this project and other projects affecting the wildlife inhabiting the project area. The area of impact for assessing cumulative effects is described above.

The effects of timber harvest and other disturbances which occurred before the current planning period are already written on the landscape, and so are considered as part of the current condition or no action alternative. The effects of timber harvest that may occur further in the future than the end of the planning period were not modeled because the effects of timber sales that would occur after the 1987-1996 sale schedule covered in the plan are not reasonably foreseeable. The increasing uncertainty of management activities not yet planned, unpredictable natural disturbances, plus the complexity of modeling the effects of tree growth, are such that looking beyond the planning period would be difficult to do.

Four groups of wildlife species have been of particular concern: 1) threatened, endangered, and sensitive (TES) species, 2) bird species dependent on snags or closed canopy forests, 3) indicator species (spruce-fir: hairy woodpecker and elk; mixed conifer: hairy woodpecker, turkey, elk, and red squirrel), and 4) big game species: elk, deer, and black bear.

## Threatened, Endangered and Sensitive Species [132, 183]

[Threatened, Endangered & Sensitive Species]

A list of Federally listed threatened or endangered species that might be found in the analysis area was requested from the U.S. Fish and Wildlife Service and the reply indicated that no listed species is found within the project area [CN4/21/92].

The reply indicated that the Mexican spotted owl, a proposed species; the New Mexican jumping mouse and southwestern willow flycatcher, Category 1 candidate species; and the occult little brown bat, spotted bat, northern goshawk, flycatcher, and white-faced ibis, Category 2 candidate species, may be found in the project area.

Category 1 candidate species are those for which the Fish and Wildlife Service has substantial information to support listing as endangered or threatened. Category 2 candidate species are those for which the Service has information indicating that proposing to list is possibly appropriate, but for which substantial data on biological vulnerability or threats are not currently known to support the immediate preparation of such rules. Candidate species have no legal status under the Endangered Species Act.

If any threatened, endangered, or sensitive species should be found during the preparation or administration of the sale, measures will be taken to protect such species, as agreed to by the Southwestern Regional Office of the Forest Service and the New Mexico Department of Game and Fish.

A Mexican spotted owl survey following Region 3 protocol was conducted in 1989 and 1990. No owls, nests or responses were identified. The habitat within the Angostura analysis area and the upper Rio Pueblo watershed is considered unsuitable for the Mexican spotted owl. Unsuitable habitat is habitat that does not currently provide the characteristics of suitable habitat, is not occupied by spotted owls, and does not have the capability of attaining the characteristics of suitable habitat at any time in the future through standard, prescribed management treatments or natural processes.

No occurrences of the New Mexican jumping mouse have been identified within the analysis area. Habitat consist of narrow zones of thick vegetation along streams and wet meadows associated with cattail marshes and ponds. Common, standard best management practices and mitigation measures such as protection of designated water courses and riparian

areas and buffers along riparian areas protect this habitat. Standard mitigation measures to protect this habitat are found at the end of chapter 2, Alternatives, pages 35 - 38, items 15, 16, 35, 36, 38.

There have been no known occurrences of the Southwestern willow flycatcher identified within the analysis area or watershed.

There have been no known occurrences of the Occult little brown bat identified within the analysis area or watershed

There have been no known occurrences of the Spotted bat identified within the analysis area or watershed.

There have been no known occurrences of the White-faced ibis identified within the analysis area or watershed.

The Rocky mountain wood lily is generally associated with moist sites within the spruce-fir and mixed conifer vegetation types. No individuals or groups of plants have been located within the analysis area or watershed. Standard best management practices and mitigation measures to protect habitat are listed in Chapter 2, Alternatives, pages 33 - 36, items 15, 16, 35, 36, 38.

Northern goshawk surveys were conducted in 1991 and 1992 using Region 3 protocol. Two sightings were reported but extensive nest searches failed to locate any nesting sites. No nesting sites or post-fledgeling areas have been identified. All harvest alternatives retain at least 92% of the present goshawk habitat capability, and the allocation of large blocks of old growth (minimum of 28% of the forested area in harvest alternatives), ensures that quality nesting and post-fledgeling habitat would remain available for goshawks.

Within the Angostura analysis area approximately 5,300 acres remain in the 81-160 year and >160 year age classes on all forested lands under Alternative G which is the most intensive harvest alternative. This represents approximately 60% of the total forested lands within the diversity unit. All other harvest alternatives retain a higher percentage of these older vegetation structural stages. This 60% figure is consistent with habitat management recommendations from the most recent research literature. Recent re-

search recommends that 60% of the forested habitat in foraging and post-fledgeling areas be maintained in vegetation structural stages 4,5, and 6 which corresponds to the 80-160 and >160 age classes. Of the remaining 40%, 20% should be in young forest (41-80 year age class) and 20% in the grass/forb-seedling/sapling structural stage(0-40 year age class) [LR8/92, pages 22-27]. Alternative G results in 34% of the forested area in young forest (80-160) and 6% in the grass/forb-seedling sapling structural stage. All other harvest alternatives result in higher percentages of mid to old age forest and lower percentages

in young forest and grass/forb-seedling/sapling structural stages.[LR8/92].

To assess the potential cumulative effects of timber harvesting on goshawk habitat, past timber sales and this proposed timber sale were analyzed. Acreage figures for alternative G were used in this analysis as it represents the most intensive harvest alternative for Angostura. A total of 29,300 acres were analyzed and includes habitat conditions created by all past timber sales within the last 10 years and estimated conditions resulting in the Angostura analysis area. Table 29 is a summary of this analysis.

**Table 29. Vegetation Structural Stages For Upper Rio Pueblo Watershed**

Vegetation Structural Stage	% of Habitat	Recommended % of Habitat [LR8/92]
Grass/Forb-Seedling/Sapling	5%	20%
Young Forest	12%	20%
Mid-Age - Mature/Old Forest	83%	60%

Future timber sales beyond the proposed Angostura (La Cueva and Alamitos 2) were not included in acreage figures as there is no way of knowing how many acres will be treated and what vegetation structural stages will result. It is very unlikely considering projected harvest levels that these two future timber sales could or would increase the Grass/Forb-Seedling/Sapling and Young Forest stages to more than 20% each and reduce the Mid-Age - Mature/Old stages to less than 60%.

Table 29 illustrates that the current mix of age and canopy cover classes is heavily weighted towards mature, densely stocked timber. The concern regarding goshawk habitat would be if and when the Mid-Age - Mature/Old Forest acres were reduced to below levels considered conducive for maintaining adequate habitat for nesting, feeding, and cover. From vegetation analysis within the Angostura analysis area and the upper Rio Pueblo watershed, Goshawk habitat for nesting and cover is more than adequate and there will be no negative effect on this habitat from implementation of this proposed timber harvest or timber harvests planned within this area in the reasonably foreseeable future.

The goshawk will benefit from an increase in additional early successional vegetation created by any of the harvest alternatives as this vegetation condition will create additional habitat for prey species (grouse, rabbits, rodents). All harvest alternatives maintain adequate habitat (at least 81% of current habitat capa-

bility) for other prey species which depend upon mature, closed-canopy forests (hairy woodpecker, red squirrel). Because of the relative higher percentage of uneven-aged, group selection harvests which create small openings throughout the spruce-fir habitat, it is estimated that Alternative D would have the most beneficial effects and the least negative effects on goshawk habitat of all the harvest alternatives. These group select harvests minimize the impacts on habitat of the red squirrel and hairy woodpecker which are considered important prey species for the Northern goshawk for this particular area. Alternative G, because of the relative higher percentage of removal harvests which generally create larger openings and larger areas of younger forests would be estimated to have the least beneficial and most negative effects of all the harvest alternatives. Alternative A (no action) will maintain 100 percent of the current habitat for red squirrel and hairy woodpecker but would not create additional habitat for other important prey species (grouse, rabbits, rodents).

## **Wildlife and Wildlife Habitat**

[Vegetation Diversity, Old Growth, Roads, ]

### **Habitat Capability**

Habitat capability describes the quality and effectiveness of the wildlife habitat within the analysis area.

Different species of wildlife have different habitat requirements. The Forest Plan objective is to provide a

diverse range of habitats to support a diverse range of wildlife species. In order to analyze the impacts and general responses of game and non game wildlife species to various vegetation treatments, the R03WILD computer model was used. This model is not expected to produce accurate predictions of actual populations of wildlife species, but is quite useful in comparing the relative magnitude of changes in habitats brought about by harvest alternatives. R03WILD provides a relative index of how habitat capability is affected by changes in the different habitat components. The major habitat components R03WILD analyzes is vegetation diversity and road

density. Table 30 displays the absolute diversity index resulting from each of the proposed alternatives. The diversity index is an overall rating from .001 to 1, with 1 representing optimum habitat conditions for a wide variety of wildlife, including wildlife species dependent upon early successional vegetation conditions and species dependent upon late successional vegetation conditions. The higher the diversity index, the more diverse range of wildlife species the habitat will support.

**Table 30. Absolute Diversity Index For Each Alternative**

	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Diversity Index Percent Increase	.315 N/A	.363 +13%	.387 +19%	.370 +15%	.384 +18%	.383 +18%	.436 +28%

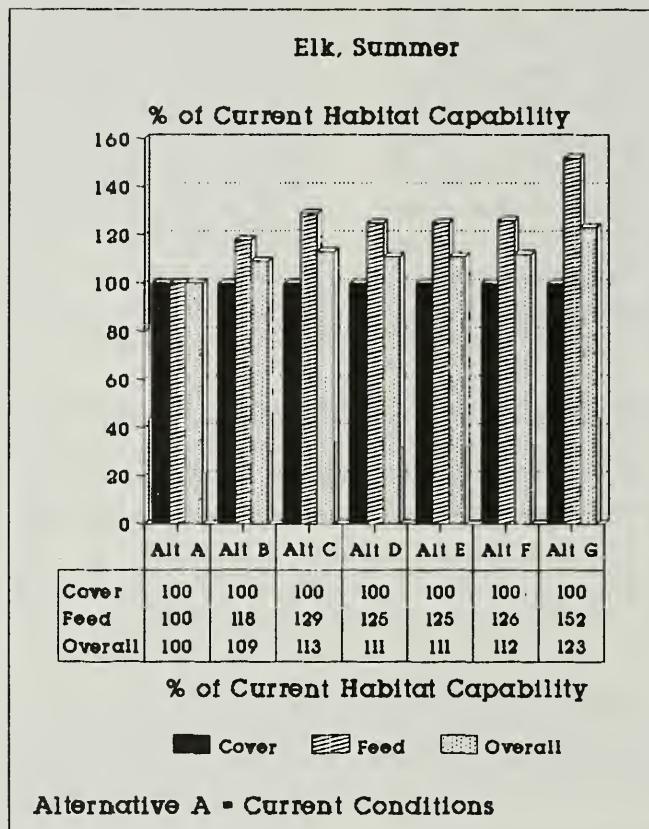
Alternative A = Current Conditions

As Table 30 indicates, all of the action alternatives increase vegetation diversity and create habitats conducive to supporting a more diverse range of wildlife species. Increases range from a 13% increase in alternative B to a 28% increase in alternative G.

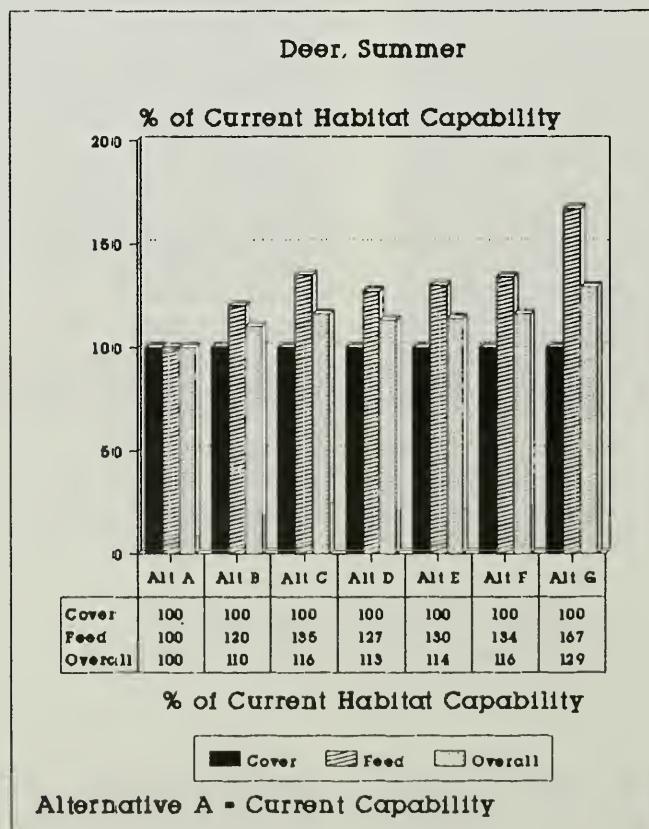
R03WILD was also used to evaluate potential effects of vegetation management alternatives upon important individual wildlife species which occur or which suitable habitat exists within the analysis area. Tables 31-37 portray the effects of the proposed harvesting on the habitat capability of important species in the analysis area. An asterick (\*) by a particular species identifies it as an "indicator species" identified in the Forest Plan. Indicator species are species of wildlife whose habitat requirements represent many other species' habitat requirements. Population changes within these indicator species are believed to indicate effects of management activities, as well as natural occurrences, on a number of other wildlife species which utilize similar habitats. The indicator species

listed in the Forest Plan for this area are elk, hairy woodpecker, turkey, and red squirrel [1986.1, page 1.Spruce <40% - 1, page 3.MC <40% - 1]. Theoretically, if resource management activities provide adequate habitat for these indicator species, it is assumed that the habitat is also effective for other species whose habitat requirements are similar. For example, retention of adequate mid to late successional vegetation conditions are desirable for the hairy woodpecker. This late successional vegetation condition is also desirable for other species such as Pygmy nuthatches and Pine martens. Conversely, elk require a portion of their habitat in early successional vegetation conditions. Deer, bear, grouse, rodents, and other small mammals which provide the prey base for ecosystem maintenance also depend upon early successional conditions as a critical part of their habitat. Tables 31 - 37 and Table 38 display the change in habitat capability from the current capability (Alt A) for the indicator species and other important wildlife species found within the analysis area.

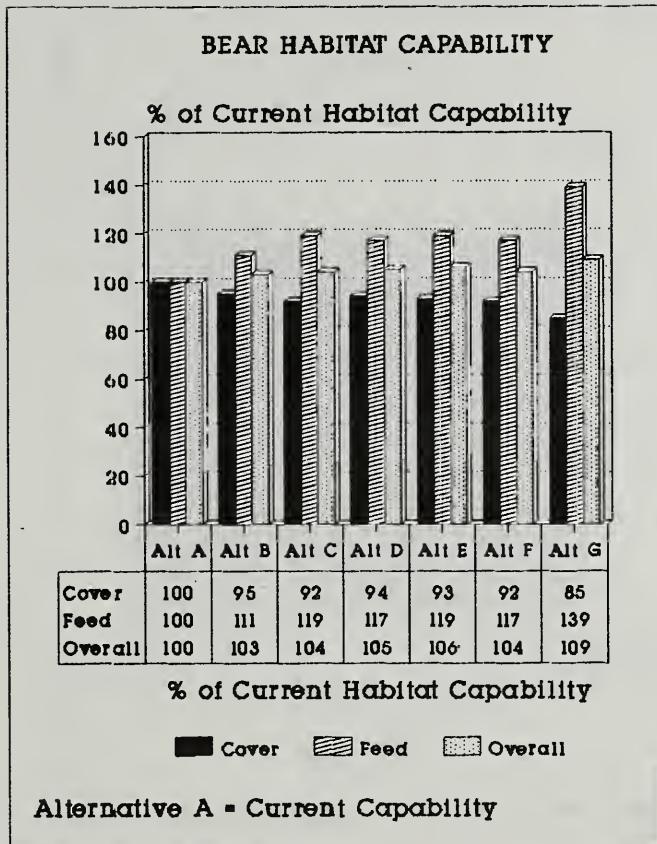
**Table 31. Elk Summer Habitat Capability (\*).**



**Table 32. Deer Summer Habitat Capability.**



**Table 33. Bear Habitat Capability.**



**Table 34. Pine Marten Habitat Capability.**

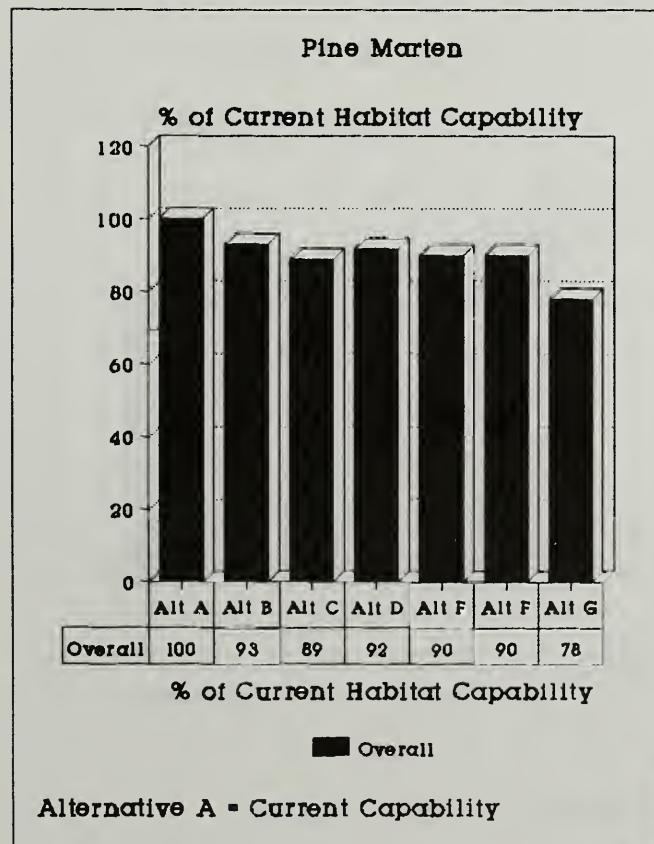


Table 35. Red Squirrel Habitat Capability (\*).

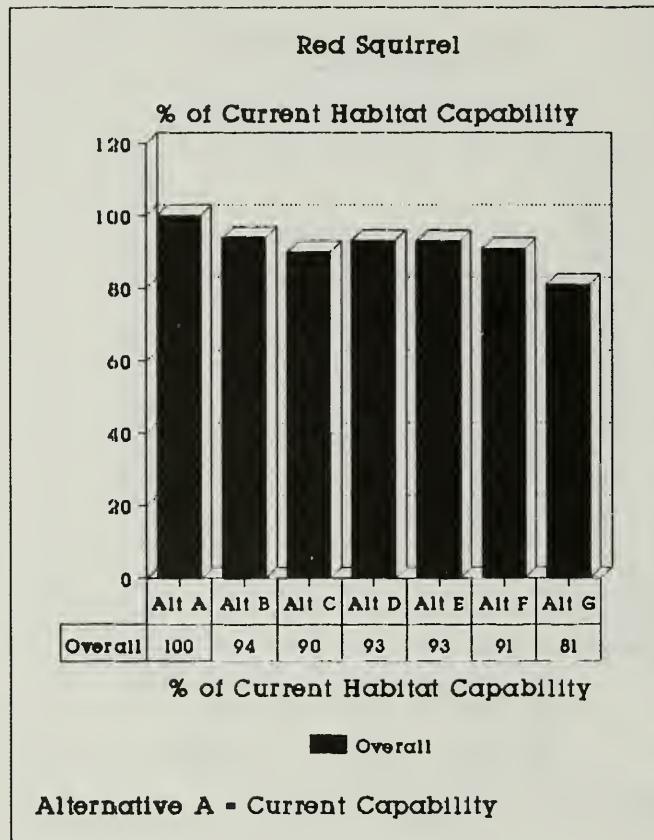
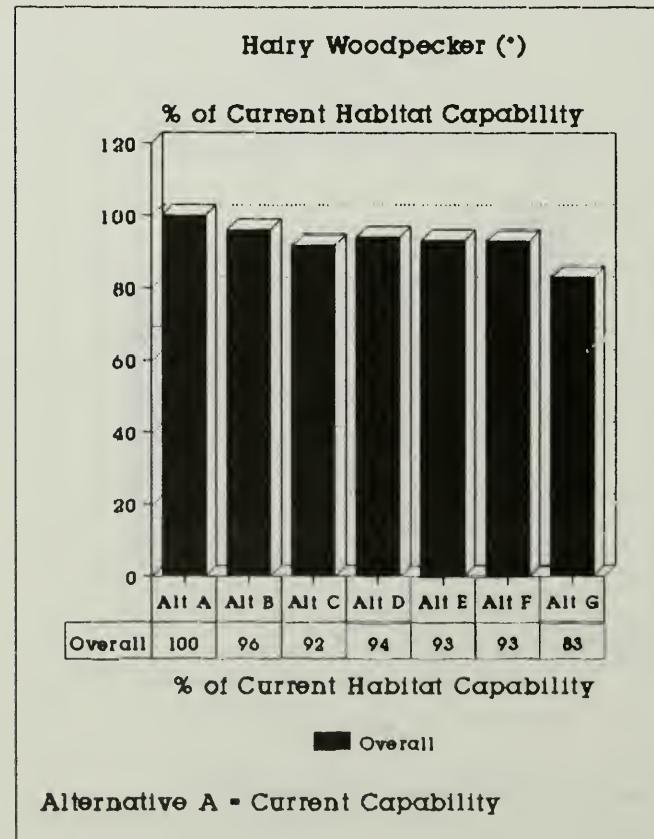
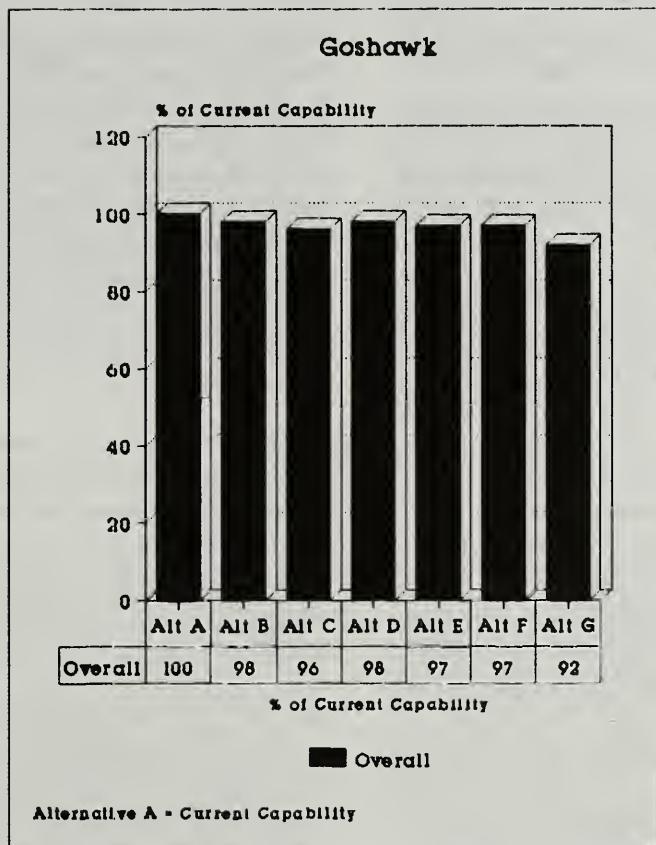


Table 36. Hairy Woodpecker Habitat Capability (\*).



**Table 37. Goshawk Habitat Capability.**



**Table 38. Wildlife Habitat Capability in Angostura Analysis Area - Percent of Existing Habitat Capability**

Species	ALT A	ALT B	ALT C	ALT D	ALT E	ALT F	ALT G
Elk (summer)	100%	109%	113%	111%	111%	112%	123%
Deer (summer)	100%	110%	116%	113%	114%	116%	129%
Bear (summer)	100%	103%	104%	105%	106%	104%	109%
Pine Marten	100%	93%	89%	92%	90%	90%	78%
Red squirrels	100%	94%	90%	93%	93%	91%	81%
Hairy woodpeckers	100%	96%	92%	94%	93%	93%	83%
Goshawk	100%	98%	96%	98%	97%	97%	92%

Cover would not be limiting for elk or deer under any alternative, and forage for elk and deer would substantially increase after timber harvesting. This is not the goal of the activity but is an added benefit to deer and elk as well as many other species. Alternatives G, C, and F respectively would have the most beneficial effects upon elk and deer habitat capability as these alternatives produce the most early successional vegetation conditions while maintaining adequate cover values.

Cover for bear would decrease under the harvest alternatives, but feeding values would increase. The decrease in cover is overestimated because the preferred cover habitat for bear is on slopes in excess of 40 percent. Slopes exceeding 40% are not considered suitable for timber harvest and therefore no harvest would occur on slopes greater than 40% slope. The R03WILD model has no way of differentiating vegetation conditions based on slope percent. Alternatives D and B respectively would probably have the least negative effect on cover and the most beneficial effects on feeding values because of their higher percentage of uneven age group selection harvest in relation to removal harvests. Bears generally prefer smaller sized openings to forage in. The group selection harvests would provide numerous small openings while at the same time protect cover values.

Pine marten habitat would be reduced under the harvest alternatives. None of the harvest alternatives reduce the habitat capability by more than 10 percent except for alternative G which reduces the capability by 22%. Pine marten surveys were conducted in 1990 and although suitable habitat exists, no Pine martens were located. Alternatives D and B respectively would have the least effect upon Pine marten habitat capability primarily because of the higher percentage of uneven age group selection harvests in relation to removal harvests.

Habitat capability for red squirrel would be reduced under the harvest alternatives. With the exception of alternative G, none of the harvest alternatives reduce the capability by more than 10%. Red squirrel is a common and widespread species whose habitat is mature spruce-fir forests. Within the Angostura analysis area there is a very healthy, widespread population of red squirrels. Considering the current population levels, a 20% reduction in habitat capability would not significantly reduce population numbers. Alternatives D and B respectively would have the least effect upon red squirrel habitat primarily because of the higher percentage of uneven age group selection harvests and a lower percentage of removal harvests.

Hairy woodpecker habitat capability would be reduced under the harvest alternatives as would be expected. With the exception of alternative G, which reduces the capability by 17%, other harvest alternatives maintain at least 92% of current habitat capability. Current habitat capability is fairly good, but since these birds are cavity nesters, the current lack of available snags somewhat limit their habitat. As unharvested areas grow older, hairy woodpecker habitat will improve. Harvest alternatives D and B respectively would least effect hairy woodpecker habitat because of the higher percentages of uneven age group selection harvests in relation to removal harvests.

The R03WILD program displays a minor decrease in Spotted owl habitat capability. Although spotted owl surveys were conducted within the analysis area with the results negative on their presence, the analysis area overall is not considered suitable habitat because of the high percentage of spruce-fir. Spruce-fir forests are rarely used by this species.

Early and late seral stages are deficient in the habitats within the Angostura Analysis Area. These specific habitats are desireable for the Goshawk. Even though the majority of the area is considered foraging habitat, most foraging conditions are tight and dense. The spruce/fir has little diversity and few small openings. All of the alternatives, with the exception of Alternative A, 'no action', would increase habitat diversity by creating a variety of Vegetative Structural Stage's (VSS) throughout the analysis area. Treatments that would result in dispersed small openings and improved growth rates in the mid-seral stages would be beneficial to the Goshawk population.

### Cumulative Effects

The most shaping of the historical actions that have taken place within the diversity unit is the large scale timber harvesting that took place between 1907-1926. The Santa Barbara Tie and Pole Company virtually cut every tree that was large enough to make a cross tie. In places this activity occurred all the way to timber line. This was the most influencing with regard to limiting biological diversity. There was also the Camezon fire in 1926 along the southwest slopes of the Aqua Piedra Canyon that now provide near mature but dense aspen stands. Actions in recent years within the diversity unit are limited to a 38 acre aspen fuelwood sale in Aqua Piedra Canyon in 1984 and some road closure activities. The Dropout and Alanitos timber sales are from one to several miles to the east of Diversity Unit. Sipapu Ski Area is several miles to the west. Future activities include the

upgrade of the Aqua Piedra Campground and possible expansion of the Sipapu Ski Area.

Considering both the negative effects and beneficial effects upon habitat capabilities by each of the harvest alternatives, the order from least impact, most beneficial to most impact, least beneficial is estimated to be alternative D, C, E, B, F, and G respectively. The higher percentages of uneven age group selection harvest in alternative D provides additional early successional vegetation conditions conducive to increasing feeding values for elk, deer and bear and increases prey base for predatory species while at the same time better protecting cover values and

nesting and roosting habitat needs. None of the harvest alternatives would be expected to reduce habitat capability below that at which viable populations of any species could be maintained.

Alternative A (no action), if implemented, would continue to favor species which depend almost exclusively on dense canopied, mature forests for their habitat needs such as the hairy woodpecker, Pygmy nuthatch, and red squirrel. Species richness would continue to decline until such time as natural agents (fire, insects) create more early successional vegetation conditions and thus more diverse wildlife habitats.

## **Disturbance**

### [Roads]

All harvest alternatives are similar in the potential effects upon wildlife disturbance. The disturbance, primarily a short term impact, will come from logging traffic during the lifetime of the timber sale contract and subsequent post sale activities (thinning), and forest product removal by the public. The timber sale contract is estimated to be in effect for 3 years followed by public firewood and other forest product removal for 2 years. Depending upon circumstances, roads would be open from 5 - 7 years after construction/reconstruction at which time they would be closed under any of the harvest alternatives. Access under all of the harvest alternatives would be limited and controlled by a gate on a temporary bridge crossing the La Sierra Ditch for the Forest Road 161 access point and a temporary bridge crossing the Rito Angostura for the Forest Road 89 access point.

In order to assess the cumulative wildlife disturbance effects, the area analyzed was the surrounding adjacent diversity units. To the west of the Angostura analysis area lies the Penasco Mountain diversity unit (Diversity Unit 10) which encompasses approximately 10,000 acres. There have been no commercial harvest activities within this diversity unit within the past 20 years and there are no harvest activities planned for the remainder of this 10 year planning period (1986 - 1996). The Penasco Mountain diversity unit contains few roads and provides a safe haven for wildlife. To the south is the Pecos Wilderness which contains approximately 25,000 acres. No harvest activities are allowed within the wilderness. To the south within the Angostura diversity unit is Management area 20. The diversity unit contains approximately 2,000 acres within Management area 20 which is not

suited for timber management and harvesting and road construction is not allowed under the Forest Plan. To the east is the Alamitos Creek diversity unit (diversity unit 17) which encompasses approximately 7,000 acres. There have been two timber sales completed within this diversity unit within the last 10 years (Dropout and Alamitos Sales). Both of these sales were completed and closed in 1992. As indicated in the mitigation section of Chapter 2 (page 35, item 1 and 2), A sale within the Angostura analysis area will not be sold until the Dropout timber sale is closed and the collector roads within the Alamitos sale are closed. To the north is the La Cueva diversity unit (Diversity unit 4) which encompasses approximately 10,000 acres. A timber sale is currently being planned for this diversity unit and is planned to sale in 1994. Excluding the La Cueva diversity unit, there is approximately 44,000 acres surrounding the Angostura diversity unit which will provide a similar, relatively undisturbed habitat for any temporary wildlife displacement that might occur as a result of harvesting and associated activities within the Angostura analysis area. Therefore it is unlikely that any significant negative effects would occur in implementing any of the harvest alternatives.

Implementing alternative A (no action) would result in no timber harvest or road construction/reconstruction and consequently would have no effect, outside of what is current, on wildlife disturbance and displacement. At present there is very little wildlife disturbance and displacement occurring and is limited primarily to motorcycles going on Trail 19, and traffic coming in and out of the Angostura summer home area which is accessed by Forest Road 89. These minor disturbances would continue.

## **Snags and Closed Canopy Forest**

[Vegetation Diversity, Old Growth]

Snags will remain available for cavity dwellers and snag-using species under any of the harvest alternatives. Proposed mitigation listed at the end of Chapter 2, Alternatives, items 50, 51, 52.

Closed canopy-mature forest and old growth currently represents 72% of the forested acres within the Angostura analysis area and 84% of the forested acres in the upper Rio Pueblo watershed. All harvest alternatives maintain at least 60% in this condition within the analysis area and 83% within the upper Rio Pueblo watershed. The Carson Forest plan currently states as an objective that by the 20th decade, 16-19 percent of the acres suitable for harvest will be in old growth and closed canopy-mature forest age and canopy cover classes, with the remaining acreage distributed more or less evenly among eight younger age classes.

Plans are being developed for inventorying and monitoring bird species dependent upon closed canopy forests. On November 11, 1991, a letter was written and mailed to Daphne Gemmil, the American Birders Association - Forest Service coordinator in a call for Forest Service Volunteer Opportunities for Birders. The letter was published in the 1992 newsletter of the American Birding Association, Inc. "Winging It Through ABA, the Forest Service can reach over

8,000 serious birders and peak their interest in volunteering for work with the Forest Service. A measure of the viability of both snag-dependent species and closed canopy habitat-dependent species is that all harvest alternatives maintain at least 83 percent of the current habitat capability for the hairy woodpecker which appears in lists of both snag-dependent and closed canopy habitat-dependent species.

There is concern that timber harvesting might leave only fragmented islands of suitable habitat for some species. Large blocks of old growth and potential old growth (much larger than just the blocks allocated as old growth) would remain after implementation of any of the alternatives.

Implementation of any of the harvest alternatives result in the mix of age and canopy cover classes being heavily weighted toward mature timber that is densely stocked (greater than 70% canopy cover) both within the analysis area and in the upper Rio Pueblo watershed. Site specific and cumulative impacts to snag-dependent and mature, closed-canopy forest dependent species from this proposed action and reasonably foreseeable proposed actions would be minimal and not constitute a significant effect.

## **Fisheries Habitat (W4/22/93)**

[Roads], [Water Quality]

Rito Angostura is an upper perennial tributary to the Rio Pueblo. Historically this was a fairly undisturbed system until the logging conducted by Santa Barbara Pole and Tie Co. in the 1910's. The road network used in this operation has persisted through time as an extensive trail system.

Historic habitat analysis data is very scarce though one such study indicates that habitat conditions were good at one site and unstable at another. Macroinvertebrate sampling was conducted on the lower Angostura in 1937. Since macroinvertebrates are essential to the growth and production of fish and because of their strict habitat requirements, they are very useful as indicators to changes in aquatic habitat. Results of this sampling indicate good representation from pollution-intolerant taxonomic Orders from both sample sites although it should be noted that one site had lower overall macroinvertebrate representatives due to the formation of a new channel.

Historic habitat data is not available for Agua Piedra Creek though it can be summarized that conditions of disturbance and recovery were similar to that of Rito Angostura.

Fisheries habitat in the upper Rio Pueblo was severely impacted early in the century but has improved over time. Early accounts of this drainage describe a severely impaired system. The first noted disturbance to the Rio Pueblo occurred as a result of logging by Santa Barbara Pole and Tie Co. in the 1910's.

Gersbacher (1935) gives a historic account of the Rio Pueblo, "Originally, it was an excellent fishing stream with an abundance of pools and shelter. About 20 years ago the Santa Barbara Tie Company floated ties down the stream. As a result the stream bed was widened and all of the holes were eliminated, allowing the water to spread out as a wide shallow sheet. The floating of these ties has also tended to straighten out the banks. Since then the flow of water has tended to make a few holes and has undercut some portion of the banks. Stream improvement work has been carried on ... consisting of the construction of dams one to one and a half feet high and "V" shaped deflectors. These dams have undoubtedly kept a great number of fish from dying during the past summer. The temperature of this stream is much higher than that of other streams of the area due to the shallow nature of the water." It was further noted that the forest ranger indicated fishing was excellent until

June 10 but that during the later portion of the season many of the fish die because the water becomes so warm. Water temperatures were recorded for two sites: four miles above Tres Ritos ( Aug. 1935- 78 degrees farenheight) and below junction with La Junta (July 1935- 63.5 degrees farenheight).

Available studies which support Gersbacher's observations show negative impacts to fisheries habitat in the upper Rio Pueblo watershed. Macroinvertebrate sampling conducted in 1937 from upper Rio Pueblo indicate poor representation of pollution-intolerant taxonomic Orders above Angostura Campground but fair to good representation from samples taken farther downstream just above La Junta confluence and three miles below it.

In the early 1960's habitat degradation was again noted. In a 1962 Harrison reported that portions of the Rio Pueblo were rechanneled due to adjacent road construction.

Macroinvertebrate surveys conducted in 1978 reflect improved fisheries habitat condition. Samples taken from upper Rio Pueblo indicate a good representation of pollution-intolerant Orders above La Junta and above Agua Piedra confluences. Habitat surveys conducted at this time upstream from Agua Piedra Campground indicate good channel stability but high fines within the system. It is noted that campgrounds and agricultural use upstream from study area may be contributing to sedimentation.

### **Historic Fisheries**

Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*) is the only salmonid species endemic to the upper Rio Pueblo watershed and probably co-evolved with minnow and sucker species. Exotic salmonid introduction into the analysis area drainages was initiated at the beginning of the century. Brook trout (*Salvelinus fontinalis*) were the first exotic species to be introduced into the Rito Angostura system in 1918. Subsequent year's stockings included Yellowstone cutthroat (*Oncorhynchus bouvieri*) in 1919, Brook trout in 1922 and cutthroat trout of uncertain purity in the late 1950's through the early 1970's. It is likely that no other fish plantings have occurred up until present within Rito Angostura. Agua Piedra Creek was initially stocked with Yellowstone cutthroat in 1919, followed by stockings of Rainbow trout (*Oncorhynchus mykiss*) in 1932 and 1965. In 1969 it is noted that both Rainbow trout and cutthroat

of uncertain purity were stocked. Cutthroat stocking had ceased by the early 1970's. Information is unavailable to substantiate how frequent Rainbow trout were stocked from 1970 until recent times, but since 1989 there has been no stocking of Agua Piedra Creek. The Rio Pueblo drainage has been stocked with exotic trout since 1906 on a near annual basis. The early stockings were of Yellowstone cutthroat trout, followed by a few Brook trout stock in the 1920's. The first Rainbow trout stock was introduced in 1928 but did not become regular stock until the early 1940's. In the 1930's and early 1940's cutthroat trout of uncertain purity was stocked in the drainage. Brown trout (*Salmo trutta*) was first stocked in 1931 and on a regular basis in the 1950's and early 1960's along with Rainbow trout.

The only historic population estimates available are for the Rio Pueblo from 1978. Hybridization of Rainbow trout with Rio Grande cutthroat was not apparent. No mixed morphological characteristics were evident on any fish sampled. Population estimates were calculated: Rainbow trout (135 fish per mile); Brown trout (1490 fish per mile); Rio Grande cutthroat (130 fish per mile).

### Current Condition

To analyze existing conditions within the analysis area selected stations on Rito Angostura, Agua Piedra and Rio Pueblo were surveyed using GAWS (General Aquatic Wildlife Survey). These surveys measure the pool to riffle ratio in the stream, depth of pools, stream bottom substrate, bank condition and stability, and general water quality parameters. The physical habitat variables are used in formulating the Habitat Condition Index (HCI). The HCI of a stream can vary from 0-100 with 100 representing the theoretical optimum quality habitat. The HCI indicates a condition and/or trend of that habitat based on the dominant and/or natural land use activity or events. HCI's of less than 100 can indicate a degree of potential for improving habitat condition. The factors used to calculate the HCI point to the specific parameter which could be improved. Of streams surveyed on the Carson National Forest, the average HCI is 64 and the average for the Camino Real Ranger District is 68.

A steep gradient stream in the best possible condition may not score the same as a moderate gradient stream in the best possible condition nor may they be expected to produce equal numbers of fish if their scores are the same. Stream gradient can be an indicator of stream productivity. Steeper streams in excess of 5% can have less of a carrying capacity for fish production compared to streams with lesser gra-

dients. The turbulent nature of the flow generally results in less resting, rearing and spawning areas available to the various life stages of the fish.

### Rito Angostura

Access to the lower portion of Rito Angostura is via Forest Road 89 which parallels the creek for approximately 1 mile. Within this stretch, there are two creek crossings; one providing fish passage via a culvert and the other, a ford. The upper access is through Forest Road 161. The road dead ends at a Rito Angostura tributary and allows access through a trail system to upper reaches of the main system.

Rito Angostura provides habitat for the Rio Grande cutthroat trout. There are no exotic species stocked in this drainage. The upper reaches of the drainage contain only native trout and are separated from the lower reaches on the main drainage, by a natural barrier. The west fork tributary system has no known barrier. The lower portion of the system contain both native and Brown trout. Rio Grande cutthroats are negatively affected by the presence of exotic trout such as Rainbow and Brown. Rainbow trout readily hybridize with the natives, reducing genetic integrity of the cutthroat and Brown trout out-compete the natives for food and space and are less susceptible to angling pressures.

Rito Angostura cutthroat trout have been genetically tested for purity and the population density has been estimated from a 1990 collection effort. Results from this testing indicate that this population is from 75% to 95% pure *O. clarki virginalis*.

Population estimates for Rio Grande cutthroat trout are 1014 per mile at the upper station, 928 per mile within the middle station, and 451 combined brown trout and Rio Grande cutthroat trout at the lower station. Rito Angostura contains one of the twenty-seven known Rio Grande cutthroat trout populations on the Carson National Forest that have been confirmed through genetic testing to be at least 75% pure. Less than half of the known pure populations have a confirmed migration barrier within the drainage that protects them from exotic encroachment. Rito Angostura provides a natural barrier that protects over three miles of habitat in the main channel from exotic encroachment.

Limiting habitat factors for Rio Grande cutthroat trout within this drainage are suspected to include water quantity, exotic species encroachment and overwinter habitat availability. These three factors greatly influence the population status within the drainage.

During the summer of 1988, five stations on Angostura Creek were surveyed using GAWS and two additional stations were surveyed in 1991. The results of the 1988 and 1991 GAWS surveys are summarized in Table 39. The average HCl for all seven stations is

67.6. This rating indicates that fisheries habitat is in good condition. The low pool quality rating (pool depth) is a function of gradient. The average stream gradient from the survey sites is 6.4.

**Table 39  
1988 & 1991 Rito Angostura GAWS Data**

Station	Discharge (cfs)	Cano-py Cover	Pool Measure	Pool Depth	Stream Bottom	Bank Cover	Bank Stability	Bank Veg.	HCI
1	5.9	85	50.1	61.4	88.1	75.0	80.0	82.5	72.8
2	3.5	39	31.5	24.6	55.5	57.5	67.5	67.5	50.7
3	2.4	32	90.9	100.0	74.4	55.0	72.5	82.5	79.2
4	4.2	76	88.4	79.9	86.6	77.5	72.5	75.0	80.0
5	4.3	82	89.4	55.9	63.1	77.5	70.0	80.0	72.7
6	0.3	19	62.0	0.0	55.3	50.0	97.5	97.5	60.4
7	0.2	19	62.8	0.0	30.3	50.0	100.0	100.0	57.2
Aver-age	3.0	50	67.9	46.0	64.7	63.2	80.0	83.6	67.6

The valley is moderately V-shaped with a floor width less than 30 meters. The channel is moderately entrenched and well confined, providing some resistance to flooding effects. Riparian vegetation is predominately spruce, aspen, willow and alder. Angostura is a perennial channel with seasonal variation in flow related to amount of snowmelt runoff. Tributaries to this system provide spawning and nursery habitat for the Rio Grande cutthroat trout. The average riparian area width is 19 meters. In the vicinity of the seven sampling stations, elevation ranges from 2682 to 3261 meters. Stream temperatures taken during late June and July range from 12.5 to 8.1 degrees centigrade. The embeddedness of stream substrate is moderate to high (65 to 75 % of substrate is covered by sediment), resulting in less habitat available for macroinvertebrate colonization. Water chemistry falls within normal ranges for Northern New Mexico streams.

#### Agua Piedra

Access to this drainage is through Agua Piedra Campground and the associated trail system. There are no roads paralleling or crossing this drainage.

Agua Piedra contains Rio Grande cutthroat trout, Rainbow trout and the hybrids of these two species, Cutbows. There are no known migration barriers within the system that would have historically and currently provided protection from hybridization between the native and exotic trouts. This is not a genetically stable population, as portions of Rito Angostura appear to be. This drainage is not stocked with exotics, but Rainbow and Brown trout have access to this system via the Rio Pueblo.

During the summer of 1988, five stations were surveyed using GAWS. The results of the surveys are summarized in Table 40. The average HCl for all stations is 63.8. This rating indicates that fisheries habitat is in fair condition. Pool quality and quantity (pool measure/depth) is a function of gradient. The average stream gradient from the survey sites is 8.1.

**Table 40**  
**1988 Agua Piedra GAWS Data**

Station	Discharge (cfs)	Canopy Cover	Pool Measure	Pool Depth	Stream Bottom	Bank Cover	Bank Stability	Bank Veg.	HCI
1	6.7	86	94.8	69.5	75.6	67.5	70.0	75.0	75.4
2	7.7	89	40.0	0.0	73.2	72.5	67.5	70.0	53.9
3	0.4	98	15.1	0.00	49.8	70.0	77.5	90.0	50.4
4	4.9	87	47.6	66.6	64.2	72.5	52.5	52.5	59.3
5	2.3	80	88.1	93.2	56.5	70.0	80.0	92.5	80.0
Average	4.4	88	57.1	45.8	63.9	70.5	69.5	76.0	63.8

The upper valley is moderately V-shaped with a floor width ranging from 24 meters in the upper reaches surveyed, to 183 meters in the lower reaches. The upper channel is moderately entrenched and well confined while the lower channel is unconfined with little to moderate entrenchment. Riparian vegetation consists predominately of aspen, spruce and alder. Agua Piedra is a perennial channel with seasonal variation in flow related to amount of snowmelt runoff. The average riparian area width is 22 meters. In the vicinity of the five sampling stations, elevation ranges from 2606 to 2835 meters. Stream temperatures taken during late June range from 13.4 to 7.5 degrees centigrade. Stream substrate embeddedness is moderate with 55 to 65% of substrate covered by sediment. Water chemistry falls within normal ranges for Northern New Mexico streams.

#### Rio Pueblo

Access to the Rio Pueblo through a paved highway (518) which parallels the drainage. Agua Piedra and

Angostura Campgrounds are located next to the drainage.

Rio Pueblo may still possibly contain Rio Grande cutthroat trout but by far the dominant salmonids are Brown and Rainbow trouts. If native trout are still vaguely present within the system, cutbows are also possibly present. Brown trout are probably the most numerous in the Rio Pueblo in spite of the approximately 5,000 Rainbow trout stocked annually in the upper system. No known migration barriers are present within the river to fortify native trout viability.

During the summer of 1989, two stations were surveyed using GAWS. The results of the surveys are summarized in Table 41. The average HCI is 61.8. This rating indicates that fisheries habitat is in fair condition. Pool quantity and quality (pool measure/depth) is low for this type of system. The average stream gradient from the survey sites is 1.7.

**Table 41**  
**1989 Rio Pueblo GAWS Data**

Station	Discharge (cfs)	Canopy Cover	Pool Measure	Pool Depth	Stream Bottom	Bank Cover	Bank Stability	Bank Veg.	HCI
1	17.5	42	55.2	56.6	58.3	75.0	90.0	80.0	69.2
2	9.2	70	32.5	0.0	62.0	70.0	80.0	82.5	54.5
Average	13.3	56	43.8	28.3	60.1	72.5	85.0	81.2	61.8

The valley bottom width ranges from 67 to 221 meters. The channel is moderately entrenched and confined which provides some resistance to flooding effects. Dominant riparian vegetation from the sample sites were fir, willow and cottonwood species. The average riparian area width is 17 meters. In the vicinity of the two sampling stations, elevation ranges from 2499 to 2652 meters. Stream temperatures taken during late June range from 16.2 to 9.6 degrees centigrade. Stream substrate embeddedness is moderate with 50 to 60% of substrate covered by sediment. Water chemistry falls within normal ranges for Northern New Mexico streams.

#### Potential Effects

Indirect effects of increased sedimentation upon the fisheries resource will be a loss of microhabitat (Meehan 1991). Increased sediment loading may affect overwintering habitat and stream productivity over the long term. Crucial overwintering habitat may be diminished and eventually lost as pools fill in with sediment. Fine material deposits first in the pools, but as the sedimentation rate increases, accumulation will also occur in the riffle areas. Juvenile trout depend on substrate relatively free of sediment for providing winter cover. Stream productivity, which directly relates to fish productivity may be impaired as substrate embeddedness increases. Many macroinvertebrates depend upon larger substrate relatively free of sediment for survival and production of healthy populations capable of supporting healthy trout populations. Pool quality in both Rito Angostura and Agua Piedra is underabundant and additional sediment accumulation in the channel would further limit overwinter habitat. Substrate embeddedness in Rito Angostura is already at a high level. Additional sediment accumulations could only further limit juvenile cover and macroinvertebrate production.

Increases in sediment loading can have long term negative effects on the major fish stages: spawning/incubation and juvenile rearing. An inverse relationship exists between amount of fine sediment in spawning or rearing areas and fish survival and abundance. Fine sediment can cover spawning gravel, decreasing the oxygen supply delivered through interstitial spaces to developing eggs. Sedimentation of these areas can occur before spawning, making the site unsuitable for redd development or after spawning. If spawn has occurred and area is covered by sediment, developing eggs do not get necessary oxygen supply and waste removal provided by complete circulation. Juvenile rearing habitat can be diminished as substrate embeddedness increases and pools lose area to sediments.

Accelerated erosion rates are probable under all action alternatives. In all action alternatives, all existing drainages will either retain most of their riparian zones or have established buffers which prevent harvesting in the riparian areas. Riparian areas have several important functions in maintaining healthy fisheries habitat of which one of the most important is serving as a sediment catch. In retaining the integrity of the riparian zones, the analysis area drainages are to a degree protected from the effects of sedimentation from harvest units and road systems. Under all action alternatives, some riparian disturbance will occur in the vicinity of road crossings. Riparian removal will be necessary to provide a cleared area for proposed road crossings and channel disturbance will occur as road crossings are constructed. Post construction sediment inputs will continue from the crossing. Under all Forest Road 89 access alternatives, approximately 1.5 miles of proposed road will not allow an adequate sized buffer and will probably contribute sediment directly to the channel.

Potential direct, long term effects from the channel road crossings also include changes to stream channel physical dimensions due to channel constriction/modification at proposed road crossings and changes in sediment loading into the stream. When channel geometry is artificially changed a stream will adjust by altering its geometry upstream or downstream of the change. The type of adjustment depends on the original geometry and composition of the channel, the type of change incurred, and the ability of the channel to reshape itself. Potential channel adjustments include changes in channel bed form, channel bed armour, channel width, channel pattern, and longitudinal profile (Heede 1980).

The potential for channel morphology alteration due to constriction is decreased if the channel can be crossed with the least disturbance to the streambed and if the culvert or other water passage design, allows for high flows. Both Agua Piedra and Rito Angostura have fairly stable banks supported by large tree root systems and streambed armour layers. Streams of this type are more stable with respect to sediment supply and generally retain narrower and deeper channels.

Potential short term effects to all fisheries with proposed road crossings and to all Forest Road 89 access alternatives, is increased turbidity. Turbidity is a measurement of interference of light penetration in water caused by suspended materials. Excessive turbidity can have a dramatic effect on fisheries. Larger juvenile and adult salmonids appear to be little affected by ephemerally high concentrations of suspended sediments that occur during most storms and snowmelt (Sorenson et al. 1977), although smaller juvenile salmonids are negatively affected by turbidities in excess of 50 NTU (nephelometric turbidity units) (Everest et al. 1982). Because juvenile salmonids are primarily sight feeders, excess turbidity at water temperatures above 5 degrees centigrade generally reduces feeding success, growth and competitive ability. Excessive turbidity can reduce angling success, even if fish production is unaffected, and raise water temperatures within the drainage. Effects to younger salmonids may be more dramatic. Newly emergent salmon fry appear to be the most affected by even moderate increases in turbidity (25-50 NTU) than are older fish. Reduced growth of fry and increased emigration was observed in turbid streams (Sigler et al. 1984). Turbidity levels are not predicted to reach significant levels for any long periods, though the potential exists for significantly elevated

turbidity levels during spring runoff, during summer rains and while channel crossings are being constructed.

If proposed *mitigation measures* are followed, damage to fisheries habitat will be lessened under all alternatives. *Surface erosion* from road networks is usually reduced through time and can be controlled through *reseeding, mulching and mechanical protection of slopes*. Other BMP's (Best Management Practices) designed to reduce surface erosion will also be implemented. Bridges and arch culverts will modify and restrict channel characteristics least and therefore be least damaging to fish habitat. *Culvert installation design* should be carefully planned so as not to interfere with natural channel flow regime. The *timing of streambed disturbances* due to road construction should be confined to the fall season so as not to interfere with cutthroat spawning. *Surplus soil and rock* should be deposited in designated areas where runoff will not threaten streams. *Servicing and refueling of machinery* should be conducted well away from streams to decrease the likelihood of stream contamination or disturbance. *Trees should not be felled into or across streams*, if at all possible, to decrease the chances for bank and channel disturbance during road construction. *Grazing impacts* to the riparian zone within the meadow along the west fork of Rito Angostura need to be decreased. Heavy livestock use of this area has degraded fisheries habitat, within the meadow only, to a poor habitat quality rating.

The extent of habitat alteration cannot be clearly quantified, but estimates predict the longterm sedimentation effects, with mitigation measures, may be present for a distance of one-hundred meters below the road crossing. This should be considered a baseline level of effects. The effects to intermittent drainages during wet seasons will be similar to those of perennial systems.

### **Comparison of Alternatives**

The extent of fisheries habitat modification within the analysis area is predominately dependant upon the number of stream channel crossings and the proximity of road alignments to the drainages. Each alternative was evaluated for the number and location of proposed crossings as taken from analysis area maps (Table 42). Each proposed road crossing will contribute sediment to the drainage in proportion to the number of crossings.

**Table 42**  
**New Stream Channel Crossings By Alternative**

Area	ALT A	ALT B	ALT C	ALT D	ALT E	ALT F	ALT G
Rito Angostura (upper)	0	1	0	1	0	0	1
Rito Angostura (lower)	0	0	1	0	1	1	0
...perennial tributary	0	3	2	3	2	2	3
...intermit. tributary	0	2	2	2	2	2	2
Agua Piedra (upper)	0	1	2	1	0	0	2
...perennial tributary	0	1	2	0	0	0	3
...intermit. tributary	0	0	0	1	0	0	2
Access Road (Forest Road)	-	161	89	161	89	89	161

Alternative A provides no management action for the analysis area, retaining current roading conditions. Under this alternative, fisheries habitat will remain as it is now, allowing for natural fluctuations.

Of the action alternatives, E and F require the least number of crossings while alternative G, the most. All alternatives with Forest Road access 89 will addition-

ally contribute sediment to lower Rito Angostura from a 1.5 mile section of road. In order to quantify the degree of fisheries habitat alteration within Rito Angostura and Agua Piedra, percentages of minimum total habitat affected were approximated. In calculating the percentages, it is estimated that each road crossing will affect approximately one-hundred meters of stream below the crossing.

**Table 43 Baseline Magnitude of Habitat Loss in Percent**

AREA	ALT'S E AND F	ALT G
Rito Angostura		
...perennial	1.5%	2%
...intermittent	4%	4%
Agua Piedra		
...perennial	0%	5%
...intermittent	0%	6%

The baseline magnitude of habitat loss, Table 43, in Rito Angostura for these alternatives is comparable, since alternatives E and F will have additional sedimentation from the section of proposed road paralleling the drainage. Affects to Agua Piedra are significantly different between the alternatives.

In considering impacts to fisheries resources within the planning area, an emphasis will be placed on the Angostura System. This system contains a genetically pure and stable population of a Carson NF sensitive species, Rio Grande cutthroat trout, above the existing migration barrier. At present this population does not appear to suffer from possible hybridization with Rainbow trout, as does the Agua Piedra system but habitat degradation could favor Brown trout encroachment where a migration barrier is lacking.

Once exotic species are in the drainage such as is seen in lower Rito Angostura and the other two drainages, unless a migration barrier is present or the

habitat is so marginal that only cutthroat can utilize it (such as some small headwater systems), the native trout's chances of retaining its place within the drainage are slim. Population studies conducted on the Rio Chiquito (Camino Real Ranger District) in 1967 recorded that 92% of the salmonids observed were Rio Grande cutthroat and the remainder were Brown trout. In 1975, 19% of the trout observed were Rio Grande cutthroat and by 1980, only 8% of the total trout observed were natives. Also equally true is the reality that exotic removal from the system is not simple and involves a chemical treatment to the stream to remove all fish. As was mentioned earlier, Rainbow trout readily hybridize with the natives and Brown trout outcompete them for food and space. Brown trout have biological advantages as well, such as season of spawning activity, eyesight better suited to turbid waters and a proclivity to avoid being captured by anglers when compared with Rio Grande cutthroat trout.

The severity of impacts to Rio Grande cutthroat trout within the Rito Angostura drainage is not certain. Estimates have been made, but, without accurate sediment models or specific sediment loading and accumulation predictions, the impacts are only a baseline prediction.

Long term effects to the Rito Angostura subpopulation is predicted to be a loss in overwinter habitat for both adult and juvenile salmonids as pool habitat is lost to sediment and substrate embeddedness increases. Spawning and incubation may be impaired as gravels become covered with fine sediment and possible changes to stream channel geometry may occur as a result of road crossings or excessive sedimentation. These changes can cause channel instability which will affect all major fish stages. Short term effects are increases in stream turbidity which may contribute to reduction in growth of fry.

Long term effects to the entire population of Rio Grande cutthroat trout may be a decline in overall population viability. This species is considered to be "diminishing" by New Mexico Department of Game and Fish and is listed as "sensitive" by the Carson N.F.. In light of the overall trend in distribution and abundance of this species in its native range (New Mexico and Colorado) and the serious threats the population encounters from exotic encroachment and habitat alteration (Behnke 1992), each system occupied by a secure population is vital to overall species recovery. Subpopulations not protected by migration barriers are far from secure (Sublette et al. 1990). If excessive habitat degradation occurs within these systems, exotic salmonids may be given an additional competitive edge causing further decline of the species.

Considering the number of stream crossings, baseline magnitude of potential habitat degradation, the miles of stream without adequate buffer under FR89 access alternatives and the existing Rio Grande cutthroat trout distribution the alternatives have been rated. This rating indicates effects from least to greatest magnitude: A,E,F,C,D,B,G

## Monitoring

In order to realize quantifiable impacts to the fisheries resource in this planning effort to assist in predictions for other planning efforts, a monitoring effort has been initiated. Pre-sale monitoring of macroinvertebrates was initiated in the summer of 1992 in Rito Angostura. Stations were established above and below three potential road crossings to gather baseline data on populations before any proposed roading might occur. The data gathered from the first year's

efforts was sent for analysis and the results are not yet completed.

The intent of this monitoring study is to conduct analysis over a five to six year period in the event of any new road construction in the analysis area. Monitoring should be conducted before, during and after any activities and coupled with fisheries population estimates. The results of the study will assist in quantifying impacts to fisheries from the action alternatives, if implemented, and to evaluate the proposed mitigations for effectiveness.

## Cumulative Effects

Cumulative effects to the upper Rio Pueblo fisheries habitat are based upon WATSED model runs used in determining cumulative impacts to the Upper Rio Pueblo watershed. Analysis area and past/future projects that were used to in the model are described under "Soil and Water" effects. Alternative E was used to represent the lowest impact alternative, while alternative G represented the highest impact alternative. The model was used to predict changes in water yield and sediment routing within the drainage. An estimate of sediment accumulation within the stream was also given.

Under both alternatives no appreciable water yield changes are predicted. Under alternative E, sediment delivered to the stream will increase 120% over natural levels within the first two years and decrease to 60% after two years. The model predicted that none of the sediment will accumulate in the stream. The alternative G model run predicted a 240% increase in sediment delivered to the stream within the first two years with a decrease to 120% in the third and fourth years. After four years, sediment delivered to Upper Rio Pueblo will level at 60%. The model predicted a 2% increase in sediment accumulation for the first three years and a 1% accumulation in the fourth year. After the fourth year there will be no further sediment accumulation.

The cumulative effects to fisheries habitat appear to be negligible under alternative E. An increase in turbidity will occur but it is not expected to be at the levels necessary to impact fish inhabitants. Under alternative G, turbidity would be greatly increased with some minor accumulations predicted within the channel. Though this level of sediment routing and accumulation within the channel is not desirable, no serious effects are predicted for fish inhabitants and habitat impacts will be minimal. Long term effects to fisheries habitat under alternative G are estimated to include some pool habitat loss, and the potential for spawning/incubating habitat loss as gravels are cov-

ered with fines. Also, a decrease in stream productivity due to increased levels of substrate embeddedness may occur. The predicted loss to fisheries habitat is minimal even under the alternative G scenario.

In addition to the road and watershed mitigations which will minimize turbidity and siltation, added measures need to be addressed to decrease the threats to Rio Grande cutthroat trout population viability. Mitigation recommendations include:

1. Installation of an additional migration barrier on Rito Angostura, above the existing ford, and the removal of any Brown trout found between the newly constructed barrier and the natural falls.
2. Take measures to insure that exotic migration cannot occur via the Sierra ditch.
3. Take measures to insure that incidental stocking of exotics into the Angostura system could not occur by the public.

There are no expected cumulative effects to the sub-population of Rio Grande cutthroat trout within the Rito Angostura drainage from any anticipated projects. There are, though, potential longterm cumulative effects to the species within the upper Rio Pueblo watershed. Alamitos, upper Rito de la Presa and Policarpio Canyon all contain genetically pure populations of Rio Grande cutthroat trout. All three drainages have recently completed and future projects in their vicinity. Habitat degradation may have occurred as a result of past activities and may be induced from future projects. Only Policarpio Canyon and Alamitos have known or suspected migration barriers to prevent exotic encroachment. These secure subpopulations represent the future of this species and extreme precautions must be taken on future projects to avoid jeopardizing their viability. Excess sediment loading to Rito de la Presa should be avoided as excessive habitat degradation will decrease subpopulation viability. Excessive sediment loading could favor Brown trout.

## ROADS

[Economic Feasibility], [Public Safety and Protection]

Impacts from roads to wildlife and water quality have been addressed in the wildlife and water sections. This section will address the issues of public safety and protection, and economics of the two primary proposed road systems and access points.

### Economic Efficiency [T2/6/92], [E7/13/92.2]

There are two primary road access routes being considered. One access point is a continuation of existing Forest Road 161 (The Alamitos road) from where it presently ends. The other access point is a continuation of existing Forest Road 89 which accesses the analysis area from State Highway 518 through Angostura campground and adjacent to private land belonging to the Angostura Homeowners Association members. Harvest alternatives B, D, and G propose access through Forest Road 161. Harvest alter-

natives C, E, and F propose access through Forest Road 89. Although each harvest alternative proposes a particular access and road system, either access point is compatible with all harvest alternatives with minor changes in harvest unit locations. Each alternative differs in the miles of road needed to facilitate logging. These mileages are listed in Table 4, Chapter 2. Table 44 is a summary of the number of miles and projected cost of the road system for each alternative.

**Table 44. Road System Mileage and Projected Cost**

	ALT A	ALT B	ALT C	ALT D	ALT E	ALT F	ALT G
Access Point	N/A	FR 161	FR 89	FR 161	FR 89	FR 89	FR 161
Miles of Road Construction/ Reconstruction	0	12.5	13.5	11.0	8.0	12.0	17.5
Cost Per Mile (\$)	0	22,800	21,000	22,800	21,000	21,000	22,800
Total Cost (\$1000)	0	285	284	251	168	252	399

The Forest Road 89 access cost approximately \$1,800 less per mile than the Forest Road 161 access. From an economic perspective, the Forest

Road 89 access is more desirable because of lower construction costs.

## Public Safety and Protection

Forest Road 161 has been used for log hauling for the Alamitos and Dropout timber sales without any major safety problems. The primary use of this road is from logging, firewood gathering, and access into the Pecos Wilderness via Serpent Lake. It is a high standard gravel road. Forest Road 89 is primarily used by the Angostura Homeowners Association members for access into their private property and has not been used for logging purposes since the early logging which occurred shortly after the turn of the century. This road also receives moderate motorcycle traffic as it is a designated motorcycle trail from State Road 518 to where it meets Trail 19. The members of the Angostura Homeowners Association are concerned that improvement of Forest Road 89 will significantly increase traffic and create safety and vandalism problems. The vandalism problem presently exists to some extent since these homes are occupied only during the summer months and vacant the rest of the year. The present condition of the road is very poor. It has poor drainage and most of the soil has washed out leaving only large rocks as the roadbed. The road frequently floods as it is located adjacent to the Rito Angostura. Because of this flooding, the Angostura Homeowners Association has asked the Forest Service to maintain the road following flooding. The road is not one normally maintained because of the low standard of the road which would require extensive maintenance while only serving a limited number of people.

Logging use and subsequent short term public use of Forest Road 89 will increase traffic over current levels for a period of 5 to 7 years. This increased use would occur during the summer and fall months when private homeowners are occupying their homes. To control traffic a gate would be placed where the proposed road crosses the Rito Angostura via a temporary bridge. After logging and subsequent firewood and products removal the temporary bridge would be removed and the road closed to vehicles except for private home access and motorcycle traffic. Long term access is not an objective. Short term logging traffic would impact the private homeowners from increased safety hazards and increased noise and dust levels for the period of the logging operation and to a lesser degree during the period when the public would be removing firewood and other products after

logging operations ceased. There is a potential that vandalism would increase simply from increased knowledge of the location of the homes (Many people are not aware of their existence.) Appropriate action would be taken to minimize the increased safety hazard through signing and posting of appropriate speed limits. If and when dust became a problem, dust abatement would be applied to the first mile of the road. Short term noise levels and disturbance of the serene environment could not be easily mitigated. In the long term (5-7 years) there is expected to be no negative impacts over the situation which now exists. There would be improved access for the homeowners from the reconstruction of the road although the homeowners have expressed no desire for improved access. Improvement of the road would reduce flood damage and allow easier and less expensive maintenance. After logging activities and subsequent road closure, traffic conditions would be improved over current conditions as removal of the temporary bridge would make vehicular access impossible from a point just beyond homeowner access. Currently, four-wheel drive vehicles drive the road for approximately 1 1/2 miles to an area known as the big meadow. This would not be possible after removal of the bridge. Since there are no more timber sales planned to the north or west of the analysis area in the foreseeable future, the road would not access any other timber sales until a re-entry was scheduled for Angostura 20 - 40 years after initial harvest.

There are no major public safety or protection concerns outside normal concerns for the Forest Road 161 access. As mentioned earlier, the road has been used by logging traffic successfully in the past without major incidents and with implementation of standard safety signing. Forest Road 161 is not located near any private homes and dust and noise levels have not been problems in the past. This road would be used again for logging purposes in 1996 for the proposed Alamitos 2 timber sale. From a cost standpoint, the more timber volume hauled on a road, the less the overall cost to the public.

From a public safety and protection perspective, the Forest Road 161 access has the least negative impact.

## **ECONOMICS**

[Socioeconomic Impacts, Costs and Benefits]

### **Setting**

Taos County is one of New Mexico's medium sized counties in terms of population, ranking 17th of New Mexico counties with 23,118 residents as counted by the 1990 census. The population of Taos County has large Hispanic (15,000 or 65%) and American Indian components (1,571 or 6.8%). The total population of Taos County grew by 18.8 percent over the decade of the 1980s, while the Hispanic population grew by 11.7 percent, and American Indian increased by 25.6 percent.

Levels of economic activity in the area served by the Camino Real District are among the lowest in New Mexico. Taos County consistently ranks among the lowest in the state in terms of income and among the highest in unemployment rates. There are very few local employment opportunities in the county with about 9,062 jobs in the entire county and about 10,600 people in the labor force. Government spending, in the form of construction projects, transfer payments, and wages is often the most important source of personal income in the county.

In 1989, the county ranked 24th in per capita income among the 33 counties in the state with an estimated \$9,158 annual income per person. The average for the state as a whole was \$13,196 or about 1-1/2 times the Taos figure. Compared to Los Alamos County (\$23,828 per person), Bernalillo County (\$15,806) and Santa Fe (\$15,795), Taos County fares even more poorly. As a result of the low incomes, transfer payments are an important contribution to the local

economy. The county rate of food stamp recipientcy, a widely accepted measure of economic and social distress, was 20.9 percent in Taos County in 1992. The town of Taos had poverty rates of 27 percent.

Unemployment rates in the county are consistently about twice that of the state as a whole. In 1990, the rate for the state was 6.3 percent while Taos County's unemployment was 14.4 percent). The rate for Albuquerque was 5.0 percent and was only 3.5 percent for Santa Fe. The preliminary unemployment rate in Taos County for August 1992 was 14.5 percent, which placed Taos County second highest in a ranking of New Mexico counties.

The industrial pattern of Taos County is heavily weighted toward three sectors: trade, services, and government. Trade accounted for almost 27 percent of Taos County employment in 1991, Services accounted for 33 percent, and Government accounted for 19 percent. The Carson National Forest, through its programs, significantly impacts the local economy. Approximately 29 percent of non-government employment and income are either directly or indirectly a result of Forest Service activities. For example, when timber is sold, loggers and processors are employed. They, in turn, spend their pay checks at the grocery store, clerks are employed, etc. Total employment in the logging and sawmill sector for Taos and Rio Arriba counties is estimated at 371, of which 49 percent or 181 is Forest Service generated.

### **Harvests and Employment**

[Socioeconomic Impacts]

Based on 1990 harvest and employment from the Vallecitos mill in Vallecitos, N.M., each one million board feet (1 MMBF) of timber harvested can provide about 1,864 person-days of employment in the wood products industry in the county. Assuming average weekly earnings of about \$225, the total earnings per one million board feet of timber harvested and processed would be about \$84,000.

Estimates for Rio Arriba and Taos Counties from the Forest Service IMPLAN model indicate that the employment "multiplier" for timber jobs for the area is

about 2.0. This means for every timber job in the area, there is one additional job supported elsewhere in the local economy. Forest Service jobs are not included in the "multiplier." Each one million board feet harvested thus provides about 3,728 person-days of employment in the local area (1,864 in the timber industry and an additional 1,864 in other sectors of the economy). This includes the effects from the additional processing at the local mills. Assuming weekly earnings of \$225, the wages and salaries provided by one million board feet of timber harvest would be about \$168,000 locally.

## Job and Income Impacts By Alternative [Socioeconomic Impacts]

Based on the total volume to be harvested in each alternative, the total job and income effects can be

estimated. The totals are summarized below. Person days of employment are converted to an annual equivalent number of jobs assuming 240 working days per year. Number of jobs is in direct proportion to volume harvested.

**Table 45. Summary of Local Effects-Angostura Sale Alternatives**

ITEM	ALT A	ALT B	ALT C	ALT D	ALT E	ALT F	ALT G
Person Days Employment Annual Basis	0	9,693	15,657	11,930	11,557	11,557	25,723
Earnings	0	40	65	50	48	48	107
Harvest Volume (MMBF)	0	2.6	4.2	3.2	3.1	3.1	6.9
Firewood (cords)	0	2,700	3,800	2,300	2,300	1,900	6,800

These job estimates do not necessarily represent new jobs in the area. They are the current jobs which could be sustained by the given volume of timber harvest. In addition, the jobs and income do not necessarily occur in just a single year. For example, Alternative G with a harvest volume of 6.9 MMBF, represents about 3 years of harvest and processing

operations. The 107 jobs then would actually be 36 jobs per year for 3 years. Alternative C would amount to 2 years of production with 32 jobs per year for two years. Jobs range from 40 in Alternative B to 107 in Alternative G. Fuelwood from the sale would provide for annual needs for from 190 households, (Alternative F) to 680 households (Alternative G).

## Costs and Benefits [E7/13/92.1, E713/92.2]

Financial evaluation or economics plays an important role in determining which alternative to select, but it is not--and should not be the only factor to be considered. The following Table 46 displays costs and benefits of each alternative. The costs include all preparation, administration and road construction. There are also many benefits associated with each alternative. It must be understood that benefits go well beyond just the monetary return of timber dollars to the national treasury. The alternatives provide socio-economic benefits as well as resource benefits. Many

of the socio-economic benefits can be expressed in tangible, quantitative measurements, such as dollars that are returned back to the State for redispersal to the Counties or number of jobs supported through sale of timber. There are also many resource benefits such as increased vegetative diversity, improved forest health and vigor, designation of old growth areas, and improved range and watershed conditions that are very hard to put a dollar figure on because these are non-commodity benefits.

**Table 46 Costs and Benefits By Alternative**

	ALT A	ALT B	ALT C	ALT D	ALT E	ALT F	ALT G
<b>COSTS:</b>							
PREPARATION (\$1000) <sup>1</sup>	0	221	357	272	264	264	587
ADMINISTRATION (\$1000) <sup>1</sup>	0	39	63	48	46	46	103
ROADS <sup>2</sup>							
...\$MBF	1.50	96	64	69	51	77	51
...Total Costs (\$1000)	1.50	249.6	268.8	220.8	158.1	238.7	351.9
<b>BENEFITS:</b>							
TIMBER <sup>3</sup>							
...Volume of Sawtimber MBF	0	2,600	4,200	3,200	3,100	3,100	6,900
...Appraised Value in \$/MBF	0	128	128	128	128	128	128
(What we estimate the timber purchaser will pay for the timber)							
...Total Potential Revenues (\$1,000)	0	333	538	410	397	397	883
...How Many Houses Can Be Built With This Volume	0	130	210	160	155	155	345
...25% of Timber Revenues Revert Back to the State for the Counties (\$1,000)	0	83	134	102	99	99	221
WILDLIFE <sup>4</sup>							
...Percent Change in Habitat Diversity	0	+13	+19	+15	+18	+18	+28
FUELWOOD <sup>5</sup>							
...Free Use Cords	0	2314	3180	1778	1744	1478	5649
...Firewood Value (Stumpage, \$5.00/cord)	0	\$11,570	\$15,900	\$ 8,890	\$ 8,720	\$ 7,390	\$28,245
...Paid Personal Cords	0	771	1060	593	581	493	1883
...Firewood Revenues (Stumpage, \$5.00/cord)	0	\$ 3,855	\$ 5,300	\$ 2,965	\$ 2,905	\$ 2,465	\$ 9,415
...KV Collections (Based on Paid Personal Permits Only)	0	\$ 964	\$ 1325	\$ 741	\$ 726	\$ 616	\$ 2354
OTHER PRODUCTS <sup>6</sup>							
...Vigas	0	7000	7000	7000	7000	7000	7000
...Number of Personal Use Permits	0	175	175	175	175	175	175
...Potential Revenues (\$1,000)	0	\$ 49	\$ 49	\$ 49	\$ 49	\$ 49	\$ 49
RECREATION <sup>7</sup>							
...Miles of New Hiking, Horseback Riding	0	12.5	12.0	11.0	6.5	10.5	17.5
OTHER BENEFITS <sup>8</sup>							
...Acres Allocated to Old Growth	0	2,950	2,450	2,600	2,875	2,690	2,735
...% of Analysis Area Allocated to Old Growth	0	34	28	30	33	31	31
...% Forested Acres Within Analysis Area Treated For Insect & Disease	0	26	28	18	0	13	42
...Improved Livestock Distribution, acres	0	253	340	327	87	138	287
EMPLOYMENT <sup>9</sup>							
...Jobs Supported	0	40	65	50	48	48	107
...Income Generated	0	\$436,185	\$704,565	\$536,850	\$520,065	\$520,065	\$1,157,535

## **PREPARATION AND ADMINISTRATION<sup>1</sup>**

These are non-discounted costs based on average Forest-wide costs. Alternative costs may vary based on the need to hire additional labor for marking or administering sale. Costs are for the most part fixed and also include wildlife, archeology, range support,

eg surveying area for T&E species and artifacts. Costs also include subsequent costs for administering products, such as viga sales and firewood sales. Costs do not include overhead in the R.O. and W.O. as those organizations would continue to exist regardless of size of this offering.

<b>Activity</b>	<b>Cost/MBF</b>
Stand Inventory, NEPA	\$ 25.00/MBF
Marking and Cruising	\$ 40.00/MBF
<b>Sub-total</b>	\$ 65.00/MBF
Other Resource Support	\$ 20.00/MBF
<b>Total Prep Costs</b>	\$ 85.00/MBF
Sale Administration	\$ 15.00/MBF

## **ROADS<sup>2</sup>**

Roads are a capital investment. The purchaser pays through the contract to build them. Alternative A, 'no action', shows costs of preliminary planning and NEPA work. Immediately following the sale the roads will be used by firewood cutters, viga haulers, thinning contractors, fire crews, recreationists, etc. In the long term, the roads will be closed and subsequently used as trails by winter and summer recreationists.

## **TIMBER<sup>3</sup>**

Twenty five (25%) percent of the revenues generated through timber sales revert back to the States to be distributed to the counties. These revenues are distributed through the authority of the National Forest Fund (NFF).

## **WILDLIFE<sup>4</sup>**

The RO3WILD computer model does not accurately predict actual wildlife populations but is quite useful in comparing the relative magnitude of changes in habitats brought about by harvest alternatives. Refer

to Table 30 which fully displays the increases in vegetative diversity.

## **FUELWOOD<sup>5</sup>**

The Free-Use firewood 'value' is the value (\$5.00/cord) that is placed on a product. The public does not pay for these permits but the value of the product goes to the user as opposed to going to the Government. The 'value' or 'benefit' to the public users as shown in Table 46 can run into the thousands of dollars.

KV (Knutson-Vandenberg) dollar collections are funds collected through a project that eventually come back to the project area for on-the-ground improvements.

## **OTHER PRODUCTS<sup>6</sup>**

Vigas are another product in great demand on the Camino Real Ranger District. Regardless of the alternative, it is calculated that approximately 7,000 vigas can be generated from the analysis area. Based on each viga being approximately 35 linear ft long, 7000 vigas equal 245,000 lin ft at .20/lin ft. equals \$49,000.00. It is also based on 1 permit/family/year, 40 viga limit.

## **RECREATION<sup>7</sup>**

The area of influence for recreation use includes the following campgrounds; La Junta, Duran, Upper La Junta, Angostura, Comales, Llanito Frio, Flechado, Agua Piedra. Pecos Wilderness, Alamitos Trailhead and the community of Tres Ritos, NM.

Recreational uses include hiking, camping, fishing, hunting, fuelwood gathering, mountain biking, off road vehical use, horseback riding, picniking, cross country skiing and snowmobiling. Period of use is year-round. Heaviest use is during May-September.

Currently the Sale area has approximately 18 miles of existing trails due to logging activities by the Santa Barbara Tie & Pole Company between 1910-1921. These roads have since grown over and are now used as trails by hikers, esquestrians. After harvesting, fuelwooding, and any planned cultural treatments have been accomplished, the newly constructed roads will be closed. These additional roads will

subsequently add to and complement the already existing trail system in the area.

## **OTHER BENEFITS<sup>8</sup>**

Through various harvesting treatments, certain areas will be more open than others. The acres listed under each alternative are acres that include Group Selections, Seed Cuts and Aspen Clear Cuts. These treatments have with them the objective of regenerating the stand. In a few years, not only will you have a young, healthy stand of seedlings, but also grasses will be established.

These more open areas will help improve livestock distribution by encouraging livestock to use these areas versus impacting riparian acres.

## **EMPLOYMENT<sup>9</sup>**

This does not include additional jobs and income created as a result of hunters, snowmobilers, firewood haulers, etc. spending money in Taos and Rio Arriba Counties. It also does not include jobs and income generated elsewhere in New Mexico and the Nation as a result of thier purchases.

## **RECREATION**

### **Visual Quality**

Because none of the Angostura analysis area suitable lands is not visible from any major travel route and is rather uniformly covered with trees, it has been classified as an area where vegetative modification can increase visual diversity (Maximum Modification class). The maximum openings would be four acres and those only in proposed post-sale aspen firewood harvest to regenerate aspen for wildlife purposes. The maximum openings of the group select harvests would be 2 acres. The landscape qualities of the area are categorized as common, and the alternative maps provide locations where harvesting would and would not take place.

As mentioned in Chapter 1, spruce-fir mortality from natural, endemic bark beetle attacks normally occurs in groups or small patches of trees. From this standpoint, alternative D would be the most favorable alternative because of the higher percentage of group selection harvests which harvests trees in small groups.

Standard mitigation measures will adequately protect visual quality resources. Mitigation measures specific to visual quality objectives are listed at the end of Chapter 2, pages 33-36, items 8, 20, 60.

### **Recreation Experience**

Existing recreation experiences occurring within the analysis will be minimally affected under all harvest alternatives. The primary existing recreation uses include; hiking, nordic skiing, hunting, and motorcycle riding. Since all existing, used trails will be buffered from harvest activities, recreation activities on these trails will not be affected. There is one place where a proposed road crosses an existing trail and one short stretch where a proposed road runs adjacent to an existing trail for approximately 100 yards. The primary impacts will be short term in nature during the period

of active logging operations when noise levels from these activities would reduce the quality of the recreational experience.

Long term impacts on hiking, mountain biking, and nordic skiing would be positive, resulting in a longer trail system (closed roads), and consequently more accessibility in the area for foot, horse, or mountain bike travel. Existing trails are in relatively poor condition because of poor location which resulted in excessive erosion.

Proposed roads from harvest alternatives would be located favorably in relation to the contour of the land

and have adequate drainage which would improve overall quality of accessibility within the analysis area.

## CULTURAL RESOURCES

Even though the Forest Plan Environmental Impact Statement analysis (2) studied cumulative impacts, this analysis looked at the specifics of this proposed project.

To ensure protection of cultural resources, the Forest complies with the provisions of the National Historic Preservation Act of 1966, as amended; Executive Order 11593; the Archeological Resources Protection Act of 1979; and the settlement to the Save the Jemez, et al./State of New Mexico litigation.

Previous surveys and sites in the area include three small surveys (fewer than 100 acres each) and one large survey. No cultural resources were recorded during the 75 acre survey for the Agua Piedra Timber Sale (Kleinschmidt, Cultural Resources Report 1984-02-033), the 1 acre survey for the Agua Piedra Fuelwood Area Road (Romero, Cultural Resources Report 1986-02-053), or the 26 acre survey for the Agua Piedra Recreation Area Rehabilitation (Feiler, Cultural Resources Report 1991-02-053).

Known sites in the area were recorded during the 2365 acre inventory conducted for the Santa Barbara Tie and Pole Sale (Gonzalez-Peterson and Peterson, Cultural REsources Report 1990-02-112). Two pre-

historic sites, 34 historic sites, and 61 prehistoric and historic isolated finds were reported. The prehistoric sites and isolates consisted of lithic scatters and individual artifacts that appear to date to Middle and Late Archaic times. Historic sites and isolates primarily consisted of structural remains, miscellaneous features and trash associated with the operation of the Santa Barbara Tie and Pole Co. during the period 1909-1926.

To date 4,365 acres have been surveyed for cultural resources. A total of 38 historic sites and 3 prehistoric sites have been found. Also, 236 isolated finds were recorded. Most of the historic sites consists of historic structural remains and associated trash. The majority of the isolated finds are small groves of Aspen carvings and prehistoric lithic scatters.

The above cultural resource survey findings have been reviewed and concurrence has been given through the State Historical Preservation Office (SHIPo). The determinations were made that the cultural resource sites can be avoided and that the proposed project will have no adverse effect.

Additional acres within this analysis area will be surveyed this 1993 field season.

## AIR

### [Roads]

Temporary effects on air quality could occur in the vicinity of roads with large amounts of surface silts or very fine sands. Heavy truck and frequent vehicular traffic might raise dust in the area around the road. This is neither permanent nor very large and can be

very dependent on soil moisture characteristics during activity periods. In conclusion, there would be little impact upon air quality from implementing any of the alternatives.

## POTENTIAL FOR FUTURE WILDERNESS DESIGNATION

As mentioned in Chapter 2, Alternatives, an alternative which proposed including the analysis area in the Pecos Wilderness was not fully developed because it is outside the scope of this proposal. Only Congress can designate wilderness. The analysis area is not part of any Forest Service wilderness proposal at present. Harvesting activities will however affect the future potential of the analysis area in regard to wilderness designation.

The portion of the analysis area within Management Area 20, Semi-primitive, Non-motorized, was at one

time a RARE II study area. It was not designated as wilderness and was dropped from further study. No harvesting or roading activities are proposed for this portion of the analysis area under any of the alternatives and therefore would retain 100 percent of its current future potential for wilderness designation. This portion is a contiguous portion consisting of approximately 2,500 acres (approximately 20-25% of the analysis area). The remaining 75-80 percent of the analysis area was not included in the RARE II study area. However, the New Mexico Wilderness

Committee has wanted this area to be designated as wilderness for many years.

Harvest alternatives B, C, D, F, and G propose harvest distributed throughout the analysis area with the exception of Management Area 20. This harvest and roading activity would likely eliminate the potential for future wilderness designation within the analysis area with the exception of that portion within Management Area 20.

Harvest alternative E proposes harvest and road construction within the southeast portion of the analysis area only (See alternative E map, Chapter 2). This alternative would eliminate the potential for future wilderness designation on approximately 40 percent of the analysis area. The remaining 60 percent of the analysis area would retain 100 percent of its current future potential for wilderness designation.

## **APPENDIX A**

## PROCESS RECORD INDEX AND REFERENCES

These documents include meeting notes, technical reports, letters and other documents generated in the analysis of the Angostura area. They are available for review at the Camino Real Ranger District office, P.O. Box 68, Penasco, NM 87553, (505) 587-2255.

SUBJECT/ DATE	DESCRIPTION	ORIGINATED	RECEIVED
LR1977 LR1986.1 LR1986.2 LR1987	LITERATURE & RESEARCH CITED (LR) SPRUCE BEETLE IN THE ROCKIES CARSON FOREST PLAN CARSON FOREST PLAN EIS ECOLOGY, SILVICULTURE, AND MANAGEMENT OF THE ENGLEMANN SPRUCE-SUBALPINE FIR TYPE IN THE CENTRAL AND SOUTHERN ROCKY MOUN- TAINS		
LR1992	OLD GROWTH FORESTS IN THE SOUTHWEST AND ROCKY MOUNTAIN REGIONS-PROCEEDINGS OF A WORKSHOP		
LR8/92	MANAGEMENT RECOMMENDATIONS FOR THE NORTHERN GOSHAWK IN THE SOUTHWESTERN UNITED STATES		
CN1/89 CN1/12/89 CN1/18/89 CN3/1/89 CN3/1/89.2 CN3/6/89 CN3/16/89 CN3/17/89 CN3/18/89 CN4/20/89 CN5/22/89 CN5/30/89 CN7/2/89 CN7/3/89.1 CN7/3/89.2  CN7/3/89.3 CN7/3/89.4 CN7/3/89.5 CN7/3/89.6 CN7/3/89.7 CN8/22/89 CN10/10/89 CN10/26/89.1 CN10/26/89.2	CORRESPONDENCE & NOTES (CN) MAILING LIST REQUEST) INITIAL IDT LTR REQUEST TO BE ON IDT IDT NOTES NEWS RELEASE MAILING LIST REQUEST IDT MTG SIGN IN SHEET OPEN HOUSE SIGN IN SHEET OPEN HOUSE SIGN IN SHEET IDT MEETING LTR IDT MTG SIGN IN SHEET LETTER-REPLY TO IDT MTG NOTES DG MESSAGE - BACKGROUND INFO IDT MTG LTR IDT MTG LTR  IDT MTG LTR IDT MTG LTR IDT MTG LTR IDT MTG LTR IDT MTG LTR IDT MTG LTR IDT MTG NOTESREST PROTECTION GUIDE MTG NOTES-EA VS EIS IDT MTG NOTES ALTERNATIVE REQUEST	K.MARTIN RANGER G.DUDA IDT RANGER J.BERDE IDT IDT IDT J.HUDSON IDT R.MARGO J.HUDSON RANGER RANGER RANGER RANGER RANGER RANGER RANGER RANGER D.BATES RANGER RANGER RANGER RANGER RANGER RANGER J.SHIBLEY IDT L.SMITH	J.HUDSON MAIL LIST J.HUDSON PROJ FILE TAOS NEWS J.HUDSON PROJ FILE PROJ FILE PROJ FILE MAIL LIST PROJ FILE J.HUDSON J.CRAWFORD G.GROSSMAN LA COMU- NIDAD E.HURTADO G.DUDA D.BATES A.CASTAGNA T.LEHRISSEY PROJ FILE PROJ FILE PROJ FILE IDT

SUBJECT/ DATE	DESCRIPTION	ORIGINATED	RECEIVED
CN12/1/89	10/26/89 IDT MTG NOTES COVER LETTER	J.HUDSON	MAIL LIST
CN1/4/90	IDT NOTES	IDT	PROJ FILE
CN2/8/90	IDT NOTES	IDT	PROJ FILE
CN5/29/90	LTR - WATER QUALITY STANDARDS & REGS	J.BERDE	J.HUDSON
CN6/30/90	LTR W/PHOTOS - WOOD LILLY ID	J.BERDE	D.STORCH
CN7/1/90	MAIL LIST REQUEST	SIERRA CLUB	RANGER
CN7/26/90	LTR - EIS REQUEST	G.GROSSMAN	F.S.
CN8/7/90	LTR - REPLY TO EIS REQUEST	F.S.	G.GROSSMAN
CN8/10/90	LTR - REPLY TO EIS REQUEST	F.S.	C.MCDONALD
CN8/14/90	FIELD TRIP REPORT	M.KNAPP	RANGER
CN8/29/90	LTR - REPLY TO EIS REQUEST	F.S.	T.JERVIS
CN8/31/90	LTR	J.HUDSON	L.KRAHL
CN9/4/90	MEMO - FISHERIES PROTECTION	M.KNAPP	RANGER
CN9/5/90	FIELD TRIP COMMENTS	FOREST TRUST	PROJ FILE
CN9/11/90	MEMO - ROAD CONCERNS RE FISHERIES	M.KNAPP	ENGINEER
CN9/27/90	MEMO - FIELD TRIP NOTES - WATERSHED	G.KUYUMJIAN	RANGER
CN11/23/90	IDT MTG LTR	J.HUDSON	G.GROSSMAN
CN12/3/90	IDT MTG NOTES	IDT	PROJ FILE
CN12/9/90	LTR - BELOW COST SALES	J.HUDSON	J.BERDE
CN12/21/90	LTR - REPLY TO BELOW COST SALES	J.BERDE	J.HUDSON
CN1/10/91	LTR - POTENTIAL ROAD USE	J.HUDSON	L.THOMPSON
CN1/23/91	LTR - USE OF FR 89 CONCERN	GARY	L.THOMPSON
CN1/29/91	LTR - USE OF FR 89 CONCERN	E.E.WESLEY	L.THOMPSON
CN2/12/91	LTR - USE OF FR 89 CONCERN	L.INGRAM	L.THOMPSON
CN2/13/91	LTR - USE OF FR 89 CONCERN	S.SANDS	J.HUDSON
CN2/18/91	LTR - USE OF FR 89 CONCERN	P.SHEPHERD	L.THOMPSON
CN2/20/91.1	LTR - USE OF FR 89 CONCERN	L.THOMPSON	J.HUDSON
CN2/20/91.2	LTR - USE OF FR 89 CONCERN	J.BRINKMANN	L.THOMPSON
CN2/22/91	LTR - USE OF FR 89 CONCERN	S.DETRUYE	L.THOMPSON
CN2/25/91.1	LTR - USE OF FR 89 - REQUEST FOR EIS	L.INGRAM	J.HUDSON
CN2/25/91.2	LTR - USE OF FR 89 & LOGGING CONCERN	F.SHEPHERD	L.THOMPSON
CN3/7/91	LTR - SET UP MTG WITH HOMEOWNERS	J.HUDSON	L.THOMPSON
CN3/29/91	LTR - USE OF FR 89 CONCERN	S.MARMADUKE	J.HUDSON
CN4/2/91.1	LTR - REQUEST FOR MEETING	L.INGRAM	J.HUDSON
CN4/2/91.2	LTR - USE OF FR 89 & LOGGING CONCERN	P&LBOEDEKER	J.HUDSON
CN4/2/91.3	PHONE CALL DOCUMENTATION W/BOY SCOUTS	J.HUDSON	W.BOGUE
CN4/3/91	LTR - USE OF FR 89 & LOGGING CONCERN	R.THOMPSON	J.HUDSON
CN4/5/91	LTR - REPLY TO 4/2/91.1 LTR	J.HUDSON	L.INGRAM
CN4/6/91	INTRDUCTORY COMMENTS BY HMOWNERS @ MTG	L.THOMPSON	HUDSON/ EDMUND
CN4/10/91	LTR - THANKS FOR MTG.	R.THOMPSON	J.HUDSON
CN4/12/91	PHONE DOCUMENTATION - SET UP MTG	J.HUDSON	L.INGRAM
CN4/25/91	LTR - USE OF FR 89 CONCERN	J.WILSON	J.HUDSON
CN6/12/91	LTR - USE OF FR 89 & LOGGING CONCERN	E.MORGAN	J.HUDSON
CN6/17/91	LTR - RE MTG WITH HMOWNERS	L.INGRAM	J.HUDSON
CN6/19/91	VISIT DOCUMENTATION - FR 89 CONCERN	J.WILSON	J.SHIBLEY
CN7/5/91	TRANSPORTATION REPORT	J.LOPEZ	J.HUDSON
CN10/17/91	DG MESSAGE RE: STATUS OF ANALYSIS	M.KNAPP	J.HUDSON
CN11/6/91	RESPONSE TO PECOS WILD ADDITION	MOEHN/ HUDSON	BINGAMAN
CN2/5/92.1	DG MESSAGE RE: INFO REQUEST	J.HUDSON	G.KUYUMJIAN

SUBJECT/ DATE	DESCRIPTION	ORIGINATED	RECEIVED
CN2/5/92.2 CN2/6/92 CN2/21/92	DG REPLY TO CN2/5/92.1 LTR - PROPOSE WILDERNESS REQUEST LTR W/ENC. NOTICE OF INTENT	G.KUYUMJIAN V.INGRAM F.S.	J.HUDSON T.OSTERMAN FED. REGIS- TER
CN3/23/92 CN4/8/92 CN4/9/92 CN4/21/92 CN4/23/92 CN6/23/92.1 CN6/23/92.2 CN7/10/92 CN8/11/92 CN8/14/92 CN8/25/92.1 CN8/25/92.2 CN9/7/92	MAIL LIST REQUEST LTR - COMMENT ON NOI DG MESSAGE W/TES SUMMARY LTR - COMMENTS ON NOI LTR W/NOI ENCLOSED RETURNED LTR-NOT DELIVERABLE RETURNED LTR-NOT DELIVERABLE SIGN IN SHEET & NOTES RE:MTG W/F.S. DG MESSAGE RE:DATA BASE PROBLEMS DG REPLY TO CN8/11/92 DG MESSAGE RE:ANALYSIS CHRONOLOGY DG MESSAGE W/ ANALYSIS CHRONOLOGY LTR - LOGGING CONCERN	J.GEDDIE B.MONTOYA B.GOODMAN J.PROPST F.S. F.S. F.S. J.HUDSON J.HUDSON S.EDMUND RANGER RANGER S.HALLMARK	J.HUDSON F.S. J.HUDSON F.S. J.HUDSON F.S. MAIL LIST G.AYERS B.LEBEDA IDT K.WINCHESTER J.HUDSON F.S. F.S. F.S.
IO1985.1 IO1985.2 IO7/89.1 IO7/89.2 IO7/89.3 IO7/89.4 IO7/89.5	<b>ISSUES &amp; OBJECTIVES (IO)</b> POSITION STATEMENT PICO PRELIM ISSUES PRELIM OBJECTIVES PRELIM EVALUATION CRITERIA OBJECTIVES/EVALUATION CRITERIA PRELIM MONITORING PLAN	IDT IDT IDT IDT IDT IDT IDT	PROJ FILE PROJ FILE PROJ FILE PROJ FILE PROJ FILE PROJ FILE PROJ FILE
W7/15/89 W7/89 W12/89.1 W12/89.2 W8/14/90 W8/19/90 W9/4/90 W9/11/90 W5/10/91 W4/21/92 W8/12/92 W8/13/92.1 W8/13/92.2 W12/22/92 W4/22/93	<b>WILDLIFE (W)</b> R03WILD SUMMARY NM STATE WILDLIFE GUIDELINES R03WILD COMPUTER RUNS HABITAT CAPABILITY SUMMARY W/GRAPHS FISHERIES MEMO HABITAT CAPABILITY SUMMARY TABLE FISHERIES MEMO FISHERIES MEMO MEMO RE:WINTER RANGE TES SPECIES LIST ALT A-G OLD GROWTH ALLOCATION OLD GROWTH ALLOCATION SUMMARY OLD GROWTH HARVESTED BY ALTERNATIVE FOREST OLD GROWTH INVENTORY SUMMARY FISHERIES REPORT	NMG&F NMG&F D.STORCH D.STORCH M.KNAPP J.HUDSON M.KNAPP M.KNAPP D.STORCH D.STORCHA J.HUDSON J.HUDSON J.HUDSON S.EDMUND K.MCMILLAN	IDT IDT IDT IDT RANGER PROJ FILE RANGER ENGINEER J.HUDSON USF&W PROJ FILE PROJ FILE PROJ FILE PROJ FILE PROJ FILE PROJ FILE
SW1989 SW12/13/89 SW9/4/90 SW9/11/90 SW9/27/90 SW12/18/90.1 SW12/18/90.2	<b>SOIL &amp; WATER (SW)</b> TES DESCRIPTION PRELIM RECOMMENDATIONS FISHERIES/ROAD MGT FISHERIES/ROAD MGT ROAD DESIGN RECOMMENDATIONS HARVEST TYPE BY TES PROPOSED ROAD DATA	IDT G.KUYUMJIAN M.KNAPP M.KNAPP G.KUYUMJIAN IDT IDT	PROJ FILE RANGER RANGER ENGINEER RANGER PROJ FILE PROJ FILE



SUBJECT/ DATE	DESCRIPTION	ORIGINATED	RECEIVED
M4 M5 M6 M7	EXISTING OLD GROWTH OVERLAY SPECIAL FEATURES OVERLAY TES OVERLAY ALTERNATIVE MAPS A-G		

# **APPENDIX B**

## **CONSULTATION WITH OTHERS**

Copies of this draft environmental impact statement are available for review at the following Forest Service offices.

Supervisor's Office  
Carson National Forest  
Land Management Planning  
208 Cruz Alta Road  
Taos, NM

Camino Real Ranger District  
Carson National Forest  
Penasco, NM

Canjilon Ranger District  
Carson National Forest  
Canjilon, NM

El Rito Ranger District  
Carson National Forest  
El Rito, NM

Jicarilla Ranger District  
Carson National Forest  
Blanco, NM

Tres Piedras Ranger District  
Carson National Forest  
Tres Piedras, NM

Questa Ranger District  
Carson National Forest  
Questa, NM

Southwestern Regional Office  
Land Management Planning  
517 Gold Ave. SW  
Albuquerque, NM

Copies of this draft environmental impact statement were sent to the following agencies, organizations and individuals, and anyone else requesting a copy.

### **ORGANIZATIONS**

Carson Forest Watch  
...Robert W. Stewart  
...Joanie Berde  
Earth First!  
...Claire Cochran  
Forest Guardians  
...Samuel M. Hitt  
Forest Trust  
Forest Watch  
...Scott Greacen  
La Comunidad  
...Joan Berde  
National Audubon Society  
...David Henderson  
...Tom Jervis  
Sierra Club - Rio Grande Chapter  
...George Grossman  
Taos Environmental Association  
...David Bates  
The Wilderness Society  
...James W. Norton  
Wildlife Legislative Council  
...Larry Caudell  
Society of Range Management

Taos Archeological Society  
High Desert Angler  
La Sierra Ditch Commissioners  
Sierra Club  
N.M. Wildlife Society  
...Lee Otteni  
N.M. Wildlife Federation  
Taos Nature Society  
Loma Linda Homeowners Assoc.  
...Jim Settle  
Angostura Homeowners Assoc.  
...L. O'Brien Thompson  
South Plains Council  
Western Earth Support Cooperative  
Trout Unlimited  
Llano Bonito  
Los Rios Anglers  
...Van Beachum  
Native Sons Adventures  
N.M. Wilderness Study Committee  
Jackalope Motorcycle Club, Inc.

### **INDIAN PUEBLOS**

Taos Pueblo  
Picuris Pueblo

BIA - Northern Pueblos Agency

#### LOCAL GOVERNMENT

Rio Arriba County Commission  
Taos County Commission  
Mora County Commission  
Taos Chamber of Commerce

#### CONGRESSIONALS

U.S. Senator Pete Dominici  
U.S. Congressman Bill Richardson  
U.S. Senator Jeff Bingaman

#### NEWS MEDIA

Albuquerque Journal  
Rio Grande Sun  
The Santa Fe New Mexican  
The Taos News

#### BUSINESSES

Bates Lumber Company  
...Dennis Bierer  
Conley Sawmill  
...Roger Tucker  
Duke City Lumber Company  
...Lawrence Crane  
...Tom Lapinski  
...Leroy Smith  
Olguin's Inc.  
...Dan Barrone  
Pacific Studs Inc.  
...Don Segotta  
Sipapu Ski Area  
...Bruce Bolander  
Wilson, Berry, Jorgenson & Fuqua  
...John F. Wilson - Attorney at Law  
Terry Gilmore Construction  
...Terry Gilmore  
Stoneback Cabinets  
...Howard Stoneback  
W.H. Moore Cash Lumber

Medite of New Mexico  
...Jim Stone

#### STATE GOVERNMENT

New Mexico Dept. of Game and Fish  
...John Klingel  
...Tod Stevenson  
...Bob Wilson  
...Joanna Lackey  
NM Environment Department  
...Brian Wirtz  
...Jim Piatt

#### FEDERAL AGENCIES

USDA - Forest Service  
...Carson National Forest, Supervisors Office  
.....Camino Real Ranger District  
.....Canjilon Ranger District  
.....El Rito Ranger District  
.....Jicarilla Ranger District  
.....Tres Piedras Ranger District  
.....Questa Ranger District  
...Santa Fe National Forest, Supervisors Office  
.....Espanola Ranger District  
...Southwestern Regional Office  
...Washington Office  
Soil Conservation Service  
Environmental Protection Agency  
...Resource Liaison Development Staff, Washington  
...EIS Review Coordinator, Dallas  
.....Robert Layton, Jr  
US Department of Interior  
...US Fish and Wildlife Service  
.....James Young  
.....Jennifer Fowler-Propst  
.....John Peterson  
...Bureau of Mines  
.....Richard Grabowski  
...Office of Environmental Affairs  
Bureau of Land Management, Taos  
...Michelle Chavez

#### INDIVIDUALS

<b>A</b>	Coponen, Emmy	Geddie, John
Arellano, Estevan	Cruz, Joe	Gonzales, Ernesto
	Curt, Cal	Gonzales, Leroy
<b>B</b>		
Bates, David	D	H
Bonneau, Bonnie	DeBuys, Bill	Hendrie, Ann
Brown, Dick	De Fibre, Montana	Hurtado, Elias
	Diamond, Stephen C.	
<b>C</b>		
Castagna, Alberto	G	
Cochran, Claire	Garcia, Maximiliano	
Cole, Bud	Gibson, Jr., William W.	

<b>I</b>		<b>N</b>	
Ingram, Lawrence		Nickols, Jean	
<b>K</b>		<b>O</b>	
Kaluta, Jane		Olguin, Herman	
Krahl, Lane			
<b>L</b>		<b>P</b>	
Lackey, Joanna		Pacheco, Manuel	
Leherissey, Scott		Phagan, Dale	
Leherissey, Tanya			<b>W</b>
Lowenstein, Marco			Walker, Frank
<b>M</b>		<b>R</b>	
Martinez, Bonifacio		Rhea, Barry	
Martinez, Rutelio Alex		Rogers, Benjamin T.	
Miller, Carol		Romero, Clarence	
Minor, Ron		Royal, Juan J.	
Mondragon, Larry			
Mondragon, Palemon			

# APPENDIX C

## PREPARERS

<u>NAME AND POSITION</u>	<u>EDUCATION AND EXPERIENCE</u>	<u>INVOLVEMENT</u>
Hudson, Joseph B. Recreation & Lands Staff Questa Ranger District	B.S. Forest Management Stephen F. Austin University Forester, Cibola NF, 4 years Silviculturist, Cibola NF, 4 years Sup. Forester, Carson NF, 4 years	ID Team Leader
Keenan, John District Silviculturist	B.S. Forestry, University of Montana 1975 Small Sale Administrator, Kootenai NF 2 yrs Forester, Prescott NF, 4 yrs Silviculturist, Carson NF, 10 yrs	ID Team Member Silviculture
Knapp, Mary Fisheries Biologist	B.A. Biology Pittsburg State University 1971 M.S. Zoology (Fisheries Mngr) Oklahoma State University 1985 Research Assistant, State of Oklahoma 3 years Fish and Wildlife Service, 4 1/2 years Fisheries Biologist, Santa Fe NF/Carson NF, 4 1/2 years	ID Team Member Fisheries
Kuykendall, Ben District Wildlife Biologist	New Mexico State University, B.S. Fisheries Biology 1975 Wildlife Biologist, BLM Las Cruces District, 2 yrs. Wildlife Biologist, BLM Taos Resource Area 12 yrs Range/Wildlife/Watershed Staff, Carson NF 3 yrs	ID Team Member Wildlife
Kuyumjian, Gregory Forest Hydrologist	B.S. Natural Resource Management, Univ. of Connecticut Hydrologist, Apache-Sitgreave NF, 11 Years Forest Hydrologist, Carson NF, 2 Years	ID Team Member Hydrology Watershed

McMillan, Kathy . Fisheries Biologist	B.S. Wildlife Science, NMSU, 1980 Siuslaw NF, Wildlife Biologist Trainee Siuslaw NF, Dist. Wildlife Biologist Malheur NF, Wildlife Biologist Malheur NF, Zone Wildlife Biologist Gila NF, Zone Wildlife Biologist Carson NF, Forest Wildlife Biologist	Fisheries
Vogler, Dave Forest Hydrologist	B.S. Watershed Hydrology, Colorado State Univ. 1978 Hydrologist, Trainee, Routt NF 1 yr Hydrologist, San Juan NF 1 yr District Hydrologist, BLM Fairbanks AK 8 yrs, Hydrologist, Mt. Hood NF 2 yrs Forest Hydrologist, Fremont NF 1 yr Forest Hydrologist, Carson NF	ID Team Member Hydrology

## OTHER CONTRIBUTORS

Berde, Joan  
 Garcia, Maria--Archeology, USFS  
 Goodman, Bill--Watershed, USFS  
 Grossman, George--Sierra Club  
 Holland, Carol--District Forester, USFS  
 Hurtado, Elias  
 Kingle, Jon--NM G&F  
 Kramer, Carveth--writer/editor/Forest Planning, USFS  
 Leherisse, Tanya  
 Lopez, Pat--Road Engineering, USFS  
 Rodriguez, Wilbert--Forestry Technician, USFS  
 Schlimgen, Amanda--Soils & Watershed, USFS  
 Shibley, John--Forester, USFS  
 Smith, Leroy--Duke City Lumber Company  
 Stevenson, Todd--NM G&F  
 Storch, Donna--Wildlife, USFS  
 Stewart, Robert  
 Wilson, Bob--New Mexico Dept. of Game & Fish

# APPENDIX D

## GLOSSARY

### -- A --

#### AGE CLASS

Interval of years, commonly 20, into which trees are grouped for management, for example 1-20 years, 21-40 years.

#### ALLOCATION

The assignment of a land area to a particular use or uses to achieve management goals and objectives.

#### ALTERNATIVE

One of several conceptual choices proposed for decision-making.

### -- B --

#### BASAL AREA (BA)

The area of the cross section of a tree stem near its base, generally at breast height (4.5 ft. from ground level). Often used as a measurement of how much of a site is occupied by trees and expressed as the collective basal area of trees on a per-acre basis.

#### BEST MANAGEMENT PRACTICES (BMP)

Application of the best available demonstrated control, technology, processes, measures and operating methods that are socially, economically, and technically feasible for controlling soil loss or improving water quality.

#### BIG GAME

Those species of large mammals normally managed as a sport hunting resource.

#### BOARD FOOT

Measure of an amount of timber equivalent to a piece 12"x12"x1".

#### BROADCAST BURN

A controlled fire on a designated area within well-defined boundaries for reduction of fuel hazard, as a silvicultural treatment, or both.

#### BUFFER STRIP

A water quality protection measure that leaves a band of area on both sides of stream with the soil, ground cover and vegetation undisturbed. It serves to keep logging debris out of the stream, filter sedi-

ments and pollutants from runoff, prevent temperature increases by shading the stream, and stabilization of the streambanks. A practice generally recommended for perennial streams. Guidelines to estimate the width of the buffer strip usually include site specific analysis including slope steepness, length, and ground cover percent.

### -- C --

#### CANOPY

The more or less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth.

#### CARSON FOREST PLAN

The plan developed to meet the requirements of the Forest and Renewable Resources Planning Act of 1974, as amended, that guides all resource management activities and establishes management standards and guidelines for the Carson National Forest.

#### CAVITY NESTERS

Wildlife species that utilize tree cavities. Primary cavity nesters excavate their own hole. Secondary cavity nesters use natural cavities or cavities created by primary cavity nesters.

#### CLEARCUT

Removal of the entire standing crop of trees from an area at one time. Also the opening that results from clearcutting.

#### CLIMAX SPECIES

An individual species that has reach a culminating stage in its succession for a given site; where the species has reached a highly stable condition.

#### COMMERCIAL THINNING

A harvest for the purpose of maintaining desirable growth rates on the individual trees that would remain by improving the spacing between trees. Health and vigor are improved by reducing crowding and removing inferior and diseased trees.

#### CORD

A pile of stacked wood containing 128 cubic feet. The standard dimensions are 4' by 4' by 8 feet. Generally contains 75-80 cubic feet of solid wood.

## CULTURAL RESOURCES

The physical remains (artifacts, ruins, burial mounds, carvings, etc.) which represent former human cultures.

## CUMULATIVE EFFECTS

The impact on the environment which results from the incremental effect of the proposed action when added to other past, present, and reasonably foreseeable future actions regardless of who undertakes such actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

-- D --

## DBH

Diameter at breast height. The diameter of a tree measured four feet, six inches from the ground level.

## DESIRED FUTURE CONDITION (DFC)

Desired Future Condition as shown in the Carson Forest Plan.

## DFC

Desired Future Condition as shown in the Carson Forest Plan.

## DIVERSITY

"The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan" [36 CFR 219.3].

## DIVERSITY UNIT

An area of land, often approximating 10,000 acres, for which management plans are developed and effects are analyzed.

-- E --

## EFFECTS

Environmental consequences or impacts as a result of a proposed action. Included are direct, indirect and cumulative impacts in both the short and long terms.

## ENDANGERED SPECIES

Plant or animal species identified by the Secretary of Interior as endangered in accordance with the Endangered Species Act of 1973.

## ENVIRONMENTAL ASSESSMENT

A document which displays a comparison of the effects of a proposed project and alternatives to it on the environment.

## EROSION

The processes whereby earthy or rocky material is worn away, loosened, dissolved and removed from any part of the earth's surface.

## EROSION CONTROL

Materials and structures utilized to reduce erosion.

## EROSION HAZARD

Predictive rating of the erosion potential for a specific soil.

## EROSION POTENTIAL

A ranking of a soils potential to erode.

## EXISTING OLD GROWTH

Stands dominated by trees that are large and old for the capability of the site. Stands which currently meet the definition of old growth in the Carson Forest Plan (Sustainable Forest section - p. 5) by having the required number of large trees, the minimum total density of all trees, the minimum number of down logs, and the minimum number of years since man caused disturbance.

-- F --

## FILTER STRIP

A water quality protection measure that leaves a band of area on both sides of a stream with minimal disturbance to soil and ground cover. It serves mainly to filter sediment and pollutants from runoff before entering a non-perennial stream. Removal of trees is permitted within the filter strip with harvest method limitations to protect the soil and ground cover (i.e., no mechanical entrance, directional felling). A practice generally recommended for intermittent and ephemeral streams. Guidelines to estimate the width of the filter strip are the same as those for buffer strips.

## FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS)

A document which is published with all the comments and responses of a draft environmental impact statement (DEIS).

## FORAGE

Forage refers specifically to all plants that are available to livestock or game animals and used for grazing or harvested for feeding.

**FOREST**  
Carson National Forest

**FOREST PLAN**  
The Forest Land and Resource Management Plan for the Carson National Forest.

**FUELS**  
Anything within the forest that will burn, usually live and dead woody vegetation, e.g., grass, shrubs, trees.

**FUEL TREATMENT**  
The rearrangement or disposal of fuels to reduce the fire hazard. Fuels are defined as both living and dead vegetative materials consumable by fire.

-- G --

**GRADIENT**  
The vertical distance water falls divided by its horizontal distance travelled downstream, usually expressed as percent.

**GRAZING ALLOTMENT**  
An area designated for the use of a prescribed number and kind of livestock under one plan of management.

**GRAZING PERMITTEE**  
An individual who has been granted written permission to graze a specified number, kind, and class of livestock for a specific period on a range allotment.

**GRAZING SEASON**  
A period of grazing to obtain optimum use of the forage resource or on public lands an established period for which grazing permits are issued.

**GROUP SELECTION HARVEST**  
The removal of small groups of trees to meet a predetermined goal of size distribution and species in the remaining stand.

-- H --

**HABITAT TYPE**  
A habitat type is the basis of a forest ecosystem classification system. It is an aggregation of all land areas potentially capable of producing similar plant communities at climax. Habitat types are usually named for the most shade tolerant tree species that will grow on the site and an understory plant that is represented with a high degree of constancy. White fir/gambel oak is an example of a habitat type found on the Carson NF.

**HIDING COVER**

Vegetation which will hide 90 percent of an elk from the view of a human at a distance of 200 feet or less. The distance at which the animal is essentially hidden is called a sight distance.

**HYDROLOGY**

Relating to the properties, distribution and circulation of water.

-- I --

**INDICATOR SPECIES**

A wildlife species whose presence in a certain location or situation at a given population level indicates a particular environmental condition. Population changes are believed to indicate effects of management activities on a number of other wildlife species.

**INTERDISPLINARY TEAM (IDT)**

A team composed of specialist in different disciplines. An interdisciplinary team is assembled because no single scientific discipline is sufficient to adequately identify and resolve issues and problems. Team member interaction provides necessary insight to all stages of the assessment.

**INTERMEDIATE CUT**

The removal of trees from a stand between the time of its formation and regeneration cut. Intermediate cutting methods include weeding, cleaning, liberation, improvement cuttings, thinnings, salvage, and sanitation.

**INTERMITTENT STREAM**

A stream that flows above ground at intervals or only flows periodically during the year.

**ISSUE**

A point, matter or question of public discussion or interest to be addressed or decided through the planning process.

-- L --

**LISTED SPECIES**

Any species which occurs on a State or Federal (as specified in context) threatened or endangered species list.

**LITTER**

This is one component of ground cover consisting of dead plant materials. In the Forest this can be needles from conifers, leaves from deciduous trees and dead parts of grass plants that are no longer attached to the plant.

**LONG-TERM EFFECT**

An impact which continues for an extended period of years and may be permanent.

**LOW/NO POTENTIAL OLD GROWTH**

Stands not capable of developing into old growth, or stands which would require longer than 100 years to develop into old growth.

-- M --

**MITIGATION**

Actions to avoid, minimize, reduce, eliminate or rectify the impact of a management practice.

**MBF (THOUSAND BOARD FEET)**

1,000 board feet of timber--roughly equivalent to one-inch flooring twenty feet by fifty feet. It also represents approximately ten trees of the average size being harvested on ongoing timber sales on the El Rito District. Another way of representing the meaning of a certain volume of timber is that it takes roughly 20,000 board feet to build a three bedroom house of 1,800 square feet. National Geographic Magazine (April 1974) stated an average two-story brick house requires 10,840 board feet of lumber.

**MMBF**

1,000,000 board feet.

**MISTLETOE**

Mistletoes are parasitic plants that cause injury to their woody plant hosts. The two types of mistletoe found in New Mexico are dwarf mistletoes and true mistletoes. Dwarf mistletoes live on conifers only, while true mistletoes occur on conifer and hardwood trees and shrubs. Dwarf mistletoes can seriously retard growth and sometimes result in death of the host tree.

-- N --

**NATIONAL FOREST MANAGEMENT ACT (NFMA)**

A law passed in 1976 that amends the Forest and Rangeland Renewable Resources Planning Act and requires the preparation of Forest plans.

**NATIONAL REGISTER OF HISTORIC PLACES**

A list (maintained by the National Park Service) of areas designated as being of historical significance. The Register includes places of local and state significance as well as those of value to the nation.

**NEPA**

The National Environmental Policy Act of 1969. The Law requires the preparation of environmental impact statements for every major Federal action which

causes a significant effect on the quality of the human environment.

**NET PRESENT VALUE**

Total discounted revenue (referred as "present value of revenues") less total discounted costs (referred as "present value of cost"). This method is one of the better financial measures of an investment. The higher the net present value, the more desirable the investment. A negative net present value represents the fact that costs were higher than revenue and the investment does not seem desirable in an economic sense.

**NET VOLUME IN BOARD FEET**

The gross board-foot volume of trees less deductions for rot and other defect affecting use for lumber. Volume is computed for the central stem from a one-foot stump to a specified top diameter.

**NO ACTION ALTERNATIVE**

The most likely condition expected to exist in the future if current management direction would continue unchanged.

-- O --

**OFF-SITE IMPACT**

An impact which effects the environment outside the boundaries of the project area.

**ON-SITE IMPACT**

An impact which effects the environment within the boundaries of the project area.

**OVERSTORY**

The uppermost canopy (tree tops) in a stand of trees.

-- P --

**PARTICULATES**

The minute particles produced from slash burning that are emitted into the atmosphere.

**PERCENT SLOPE (GRADIENT)**

A measurement of the steepness of a slope determined by dividing the vertical increase by the horizontal distance traveled. Therefore 100% slope is equal to a 45 degree rise and a 40% slope is equal to a 22 degree rise. The latter is the cut-off point where the skyline logging system is required in order to harvest timber.

**PERSONAL USE**

Used to describe the type of permit issued for removal of wood products (Firewood, posts, poles, latillas and Christmas trees) from National Forest System

land when the product is for home use and not to be resold for profit.

#### POTENTIAL OLD GROWTH

Stands not meeting the old growth definition but with the potential to develop into old growth within 50-100 years. Must meet the definition of potential old growth in the Carson Forest Plan (Sustainable Forest section - p. 5) by having the required number of large trees and the minimum total density of all trees.

#### PREFERRED ALTERNATIVE(S)

The alternative(s) recommended for implementation based on the evaluation completed in the planning process.

#### PRESCRIBED FIRE

The intentional application of fire to wildland fuels in either their natural or modified state under such conditions as to allow the fire to be confined to a predetermined area and, at the same time, to produce the intensity of heat and rate of spread required to further certain planned objectives of silviculture, wildlife management, etc.

-- R --

#### RANGER DISTRICT

Administrative subdivisions of the Forest supervised by a District Ranger who reports to the Forest Supervisor.

#### RECONSTRUCTION

Road or trail construction activities which take place on an existing road or trail and raise the standard of the road or trail. This can include relocation of the facility in a completely new location.

#### RECORD OF DECISION

A document, separate from but associated with an environmental impact statement, that publicly and officially discloses the responsible official's decision on which alternative assessed in the EIS will be implemented.

#### REFORESTATION

The natural or artificial restocking of an area usually to produce timber and other wood products, but also to protect watersheds, prevent soil erosion, and improve wildlife, recreation, and other natural resources. Natural reforestation includes site preparation to reduce competing vegetation and provide a mineral seed bed for seed provided by seed trees. Artificial reforestation is the planting of seedlings, cuttings or seeds by hand or mechanical means and may include site preparation.

#### REGENERATION

This term can be used in two ways, the actual seedlings and saplings existing in a stand, or the act of establishing the young trees.

#### REGION 3

The Southwest Region. A Forest Service organizational unit consisting of all National Forests in New Mexico and Arizona plus four National Grasslands in Texas, Oklahoma, and New Mexico.

#### REVEGETATION POTENTIAL

The ability of the soil to revegetate.

#### REMOVAL HARVEST

All cuttings of mature trees after establishment of the new stand are removal cuts. The objectives of the removals is to provide improved growing conditions for the new stand and to harvest remaining mature trees. More than one removal can be scheduled for a stand. The last removal cutting is called the final removal.

#### RIPARIAN AREA

Land areas which are directly influenced by water. They usually have visible vegetative or physical characteristics showing water influence. Streambeds, lake borders, or marshes are typical riparian areas.

#### ROAD CLOSURE

Not allowing motorized vehicles on a road by physically blocking access and/or posting notices and/or signs. The road remains on the Forest Transportation Inventory System with the intent of reusing the road at a future time.

#### ROAD DENSITY

The number of miles of road per square mile.

#### ROAD OBLITERATION

Eliminating an unneeded road and returning the land it occupied to production or another use. The road is removed from the Forest Transportation System. When needed for resource protection or to adhere to the Forest Plan, additional measures such as scarification, seeding or possibly elimination of all roadway features will be done.

-- S --

#### SAWTIMBER

Trees that are 9.0 inches DBH or larger and can be made into lumber.

#### SCOPING PROCESS

Determination of the issues to be addressed in an EIS.

## **SEDIMENT**

Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's.

## **SEED CUT**

This cut is the removal of trees in a mature stand so as to effect permanent opening of its canopy and to provide conditions for securing regeneration from the seed of trees retained for that purpose. In addition, enough trees are retained to provide at least some modification of the exposed microclimate that would result from clearcut or seed tree methods.

## **SENSITIVE SPECIES**

Those species of plants or animals that have been placed in the Federal Register as proposed for classification and are under consideration for official listing as endangered or threatened species.

## **SHORT-TERM EFFECTS**

Those effects which will not be significant beyond the planning horizon of 50 years.

## **SILVICULTURE**

The art and science of managing a forest ecosystem to achieve specified management objectives.

## **SILVICULTURAL SYSTEM**

"A management process whereby forests are tended, harvested, and replaced, resulting in a forest of distinctive form. Systems are classified according to the method of carrying out the fellings that remove the mature crop and provide for regeneration and according to the type of forest thereby produced." [36 CFR 219.3]

## **SLASH**

Debris left after logging, pruning, thinning or brush cutting, and large accumulations of debris after wind or fire damage. Slash includes logs, bark, branches, and stumps.

## **SNAG**

A standing dead tree larger than six inches in diameter at breast height.

## **SNAG RECRUITMENT**

Reservation of suitable live trees near death for replacement of snags in the future or killing trees to create new snags.

## **SOIL PRODUCTIVITY**

The capacity of a soil, in its normal environment, to produce a specific plant or sequence of plants under a specific system of management.

## **SPECIES**

A group of similar individuals having a common origin and continuous breeding system.

## **STAND**

A community of trees possessing sufficient uniformity as regards composition, constitution, age, spatial arrangement, or condition, to be distinguishable from adjacent communities, so forming a silvicultural management entity.

## **STOCKING**

Refers to the basal area or number of trees per acre in a stand. Stocking levels can be prescribed to meet management objectives such as improving forage habitat for wildlife, or improving growth rates of trees.

## **STRUCTURE**

As applied to plant communities, the pattern and complexity of vegetation layers (e.g. trees, shrubs, understory herbs).

## **SUCCESSION**

The progressive changes in plant communities toward climax.

## **SUITABLE**

Land to be managed for timber production, during the current planning period, on a regulated basis; does not preclude management for other resource objectives as well. The process for identifying such land is defined in FSH 2409.13 and 36 CFR 219.14.

## **SUSTAINED-YIELD OF PRODUCTS AND SERVICES**

"The achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the National Forest System without impairment of the productivity of the land." [36 CFR 219.3]

-- T --

## **TERRESTRIAL ECOSYSTEM INVENTORY (TES)**

A systematic inventory based on the concept that within the landscape there are naturally occurring ecosystems with unique sets of properties. These terrestrial ecosystems form a continuum and can be recognized at different levels in classification systems. The soils component of the ecosystem is inventoried through the use of "Soil Taxonomy," USDA Soil Conservation Service Handbook #436, and the "Terrestrial Ecosystem Vadose and Phreatic Survey Procedure," a Forest Service handbook. The vegetation component of the ecosystem is inventoried through the use of the International Classification and Mapping of Vegetation, UNESCO, and the above mentioned Forest Service handbook. The terrestrial

ecosystem inventory is sometimes referred to as "soil survey."

#### THERMAL COVER

Vegetative cover providing protection for animals from heat and cold; normally used when describing habitat requirements for elk and deer.

#### THINNING

An intermediate cut made in the favored species to accelerate diameter growth and to improve the form of the remaining trees without permanently breaking the canopy. A thinning can be either a commercial or precommercial thinning depending upon the tree size (product) and economic value, if any. Precommercial thinning costs are usually charged against future stand value.

#### THREATENED SPECIES

Those plant or animal species identified by the Secretary of Interior as threatened in accordance with the Endangered Species Act of 1973.

#### TIMBER STAND IMPROVEMENT (TSI)

A loose term comprising all intermediate cuttings made to improve composition, constitution, condition and increment in a timber stand. As applied in this Plan TSI usually means precommercial thinning.

#### TOLERANCE, SOIL LOSS

The maximum rate of soil loss that can occur while sustaining inherent site productivity.

-- U --

#### UNDERSTORY

The trees occupying the lower level of a stand that has at least two size and age classes. The understory lies beneath the overstory.

#### UNIVERSAL SOIL LOSS EQUATION (USLE)

Empirical erosion model that computes long-term average soil losses from sheet and rill erosion under specified conditions.

#### UNSUITABLE

An area of land not capable of producing 20 cubic feet of volume per acre per year, or an area where regeneration can not be assured, or an area where irretrievable resource damage may occur during harvesting operations, or an area of land over 40 percent slope.

-- V --

#### VEGETATIVE STRUCTURAL STAGES (VSS)

A method chosen by the Goshawk Scientific Committee for classifying successional stages and measuring the vegetative diversity of the forest. This is a landscape ecology approach that provides habitats and food chains for a broad variety of wildlife species. The vegetative structural stages are defined as followed:

- VSS 1, Areas dominated by grasses, forbs and shrubs
- VSS 2, Forests dominated by seedlings and saplings
- VSS 3, Young forests, dominated by trees 5-12 inches in diameter
- VSS 4, Middle aged forests, dominated by trees 12-18 inches in diameter
- VSS 5, Mature forests, dominated by trees 18-24 inches in diameter
- VSS 6, Old forests, dominated by trees 24 inches and greater in diameter

#### VIEWSHED

The total landscape seen from all or part of a travel route or use area.

#### VISUAL MANAGEMENT SYSTEM

The management system used to protect or enhance visual resources.

#### VISUAL QUALITY OBJECTIVES (VQO)

Degree of acceptable alterations of the characteristic landscape based on users' expectations and visual perceptions. An example is (MM) Maximum Modification: Man's activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.

-- W --

#### WATERSHED

The entire area that contributes water to a drainage or stream.

#### WATERSHED CONDITION

Is the health of the watershed with respect to erosion and runoff conditions of the land based on ground cover conditions.

#### WATER QUALITY

The biological, physical and chemical properties of water that make it suitable for given specified uses.

#### WATER YIELD (QUANTITY)

That portion of the annual precipitation which contributes to stream flow and recharge of the ground water table.

#### **WESTERN SPRUCE BUDWORM**

A primary insect pest on the Carson NF, the western spruce budworm has caused significant defoliation, growth loss and mortality. Host trees for this insect include white fir, corkbark fir, Douglas-fir and spruce.

#### **WETLANDS**

Any area that is more or less regularly wet or flooded. Where the water table stands at or above the land surface for at least part of the year.

#### **WILDERNESS**

Under the 1964 Wilderness Act, wilderness is undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation. It is protected and managed so as to preserve its natural conditions.

#### **WILDFIRE**

Any fire on wildlands other than one intentionally set for management purposes and confined to a predetermined area.

#### **WILDLIFE**

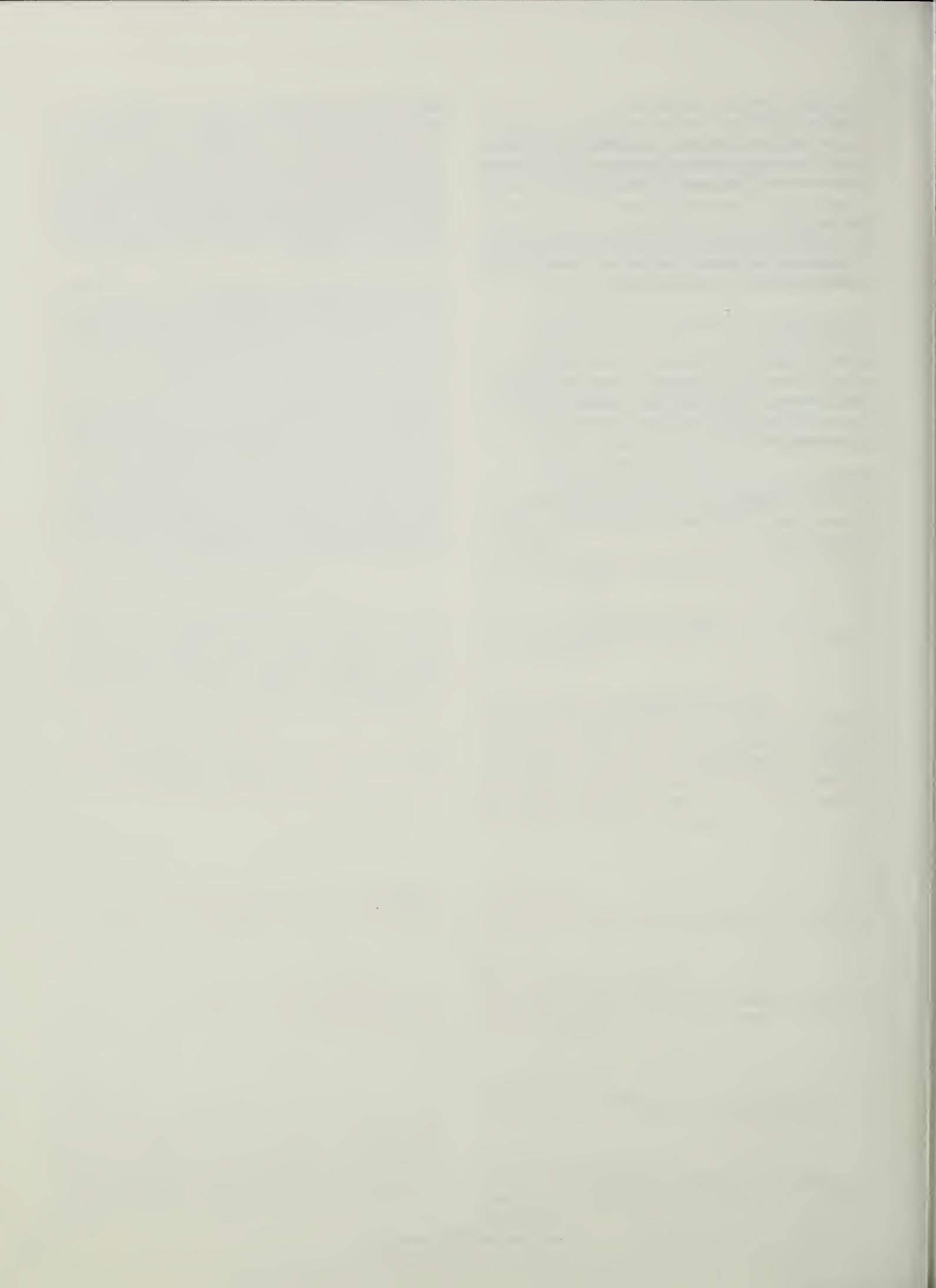
All nondomesticated mammals, birds, reptiles, and amphibians living in a natural environment, including both game species and nongame species. Animals, or their progeny, which once were domesticated but escaped captivity and are running wild (i.e., feral animals), such as horses, burros, and hogs, are not considered wildlife.

#### **WILDLIFE HABITAT DIVERSITY**

The distribution and abundance of different plant and animal communities and species within a specific area.

#### **WINTER RANGE**

Habitat used by wildlife species during the winter months to provide food and shelter and which generally limits the population. For planning purposes, areas of land where 75 percent of the individuals in a population can be expected to be found during average winter (snowfall and temperature) conditions from December 15 through April 15.



NATIONAL AGRICULTURAL LIBRARY



1022270098

Ar

NATIONAL AGRICULTURAL LIBRARY



1022270098

1 National Forest  
o Real Ranger District  
ox 68  
co, NM 87553